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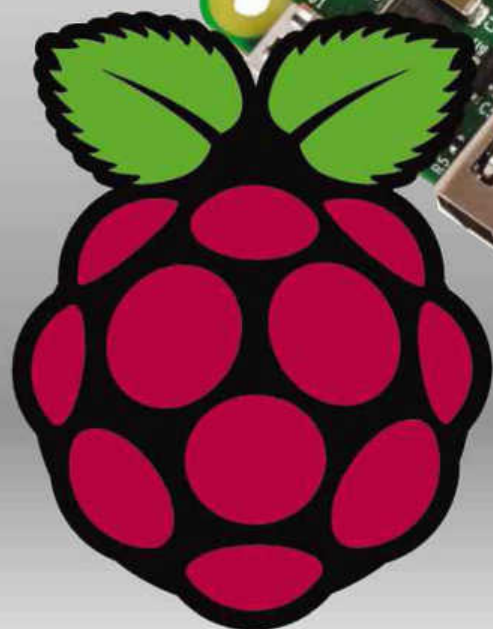
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- Get More From The Google Chromecast
- How To Get An SSD For Only £5!
- Making The Most Of The New Amazon Tablet

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### 08 Raspberry Pi 3

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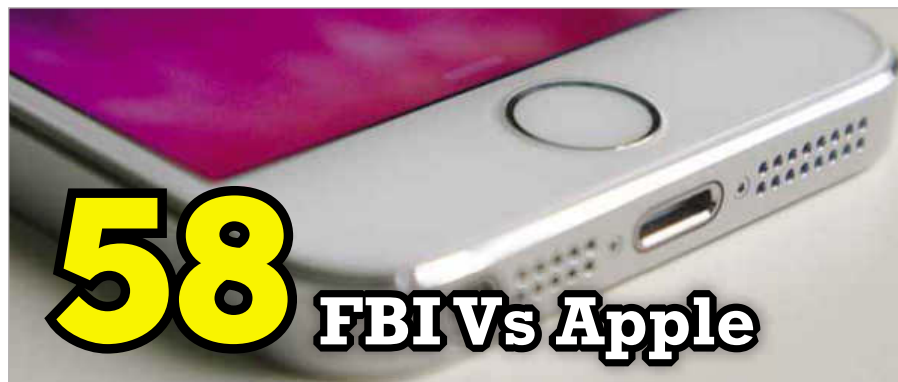
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# 50 Mini Projectors



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## 58 FBI Vs Apple

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# Fancy A Fresh Slice Of Pi?

**David Crookes cuts into the latest Raspberry Pi and licks his lips in anticipation...**

In February 2015, the Raspberry Pi Foundation believed it had a record breaker on its hands. An impressive five million Raspberry Pis had been sold in total, which just edged it above the ZX Spectrum and led to early claims that it had become the biggest-selling British computer of all time. Then someone mentioned the Amstrad PCW range had sold eight million and was also very much British, and it caused a bit of backtracking.

Fast forward a year to 29th February 2016, though, and not only was the Raspberry Pi celebrating its fourth birthday, but it was also announcing that it, too, had sold eight million units. It was a staggering figure, which pointed to three million sales in just 12 months. "We're calling it," said foundation co-founder Eben Upton. "We're the best-selling UK computer ever."

Some companies would perhaps celebrate this amazing feat with a bottle of bubbly and a slice of cake, and perhaps that's what the Raspberry Pi Foundation team did (deservedly so). But they also went one further and gave everyone a present of sorts. They announced the Raspberry Pi 3 – a brand new version of the bare-bones computer that has shaken and rattled the industry, the hobby market and the approach to teaching ICT. We wouldn't be surprised if it has increased the total sales to 10 million before the year is out.

As if to underline just how important the Raspberry Pi has become, the announcement of the £30 computer was immediately seized on not just by the specialist press but mainstream newspapers and magazines too (the *Mirror* called it "world-changing", which, in some sense, has a grain of truth in it). This is the machine that has been sent to the International Space Station along with astronaut Tim Peake, and it's the mini-marvel that has opened up coding to a whole new generation. Small it may be, but its impact has been undeniably huge.

For those who are unaware, the Raspberry Pi 3 Model B is the latest release of the most pioneering range of bare-bone computers around today. It comes without any protective casing nor any leads, but it can be connected to a computer monitor or television and make use of a standard keyboard

and mouse. As well as deliberately keeping the manufacturing costs low, the "nakedness" of the computer invites exploration and creative thinking. It shows the components that make up a computer, and it encourages experimentation.

At the same time, it evokes the ethos of the home computers of the 1980s. Just as those retro machines had a blinking prompt just waiting for you to tap in a quick 10 PRINT "Steve smells" 20 GOTO 10 in Dixons to much mirth, the Pi has also looked to make it easy for people to start programming from the very start. Even so, it can be used for other desktop computing tasks, and there's a web browser to hand and lots of games available. You could use it as a work

“ It has a faster 64-bit processor and a built-in wi-fi connection ”

computer, but that would be criminal given there's so much else it can do.

Given this background, the Raspberry Pi 3 Model B demands a look, but what does it bring to the table? Well, it has a faster 64-bit processor and a built-in wi-fi connection, but it's the latter which excites the Pi team the most. Upton talks about it being a "big step" for the computer. Over the small number of years of the Pi's existence, this has had a fair few people gnashing their teeth in frustration, because they've had to look around for the 'missing' element. In truth, it's a convenient step but perhaps not killer enough for jaws to drop.

Still, although the need to connect an external antenna was something of a learning process – an achievement for newbies to 'unlock', if you will – having it firmly on board from the off is a step in the right direction. The connectivity is provided in the guise of a built-in Broadcom BCM43438 chip



that allows for 2.4GHz 802.11n wireless LAN. It eliminates the need for wired Ethernet, USB wi-fi adapters or Ethernet-to-wireless gadgets, and it should make the computer even more accessible to users.

On top of that, the Broadcom chip has built-in Bluetooth Low Energy and Bluetooth 4.1 Classic radio support, which means users can connect up a wireless keyboard or mouse out of the box while allowing the computer to communicate with a host of other devices. "This is the first Pi you can stick behind your TV and completely forget about," Upton has said (it can be plugged directly into a USB port and draw power). It will certainly be a boon for anyone looking to put the computer at the heart of an Internet of Things smart-home given, that it will be able to talk to all manner of gadgets.

The other major difference between the Pi 3 and its predecessor is the freshly made Broadcom BCM2837 system-on-chip (SoC). Upton says it retains the same basic architecture as its predecessors, BCM2835 and BCM2836, and he points out that this means it will work with all the existing tutorials and projects that had proliferated around this machine. But there are some major advances.

## “ Upton said the UK government had declined to provide funds ”

The new Pi has a 1.2GHz 64-bit quad-core ARM Cortex-A54 CPU, which is ten times faster than the original Pi (it's up to 60% faster than the Pi 2). It has 32KB Level 1 and 512KB Level 2 cache memory as well as a VideoCore IV graphics processor. The SoC also links to a 1GB LPDDR2 memory module to the rear of the board.

In all other respects, though, the Raspberry Pi 3 is very much the same as the Raspberry Pi 2 (save for the moving of the LEDs). It's less a revolutionary leap, more a few steps forward, and yet it does consolidate the computer's capabilities. Upton appears very much aware of this, and he's suggested the new Pi is looking to make life easier for the current users of the device. He has said that people tend to use it as a replacement for a PC or as an embedded computer. "The Pi 3 is doubling down," he says, as opposed to the team looking to expand the capabilities and figure out new markets and uses for it.

What that means is the Raspberry Pi 3 has, like the Pi 2 before it, four USB ports, a full HDMI port, 40 GPIO pins, an Ethernet port, a camera interface and combined 3.5mm audio jack and composite video. It has a display interface and a micro-SD card slot that is now push-pull instead of the previous push-push. It won't mean the end of the Raspberry Pi 1 Model B+ or the Raspberry Pi 2 Model B, though. Both are remaining on sale (for as little as £21.59 and £29.40 respectively). And it doesn't mean you can't snap up the cut-down original Pi Model A+ for £18.60 (a Pi 3 Model A+ is said to be coming soon). The slices of Pi have just become more plentiful.

## Educating The Masses

What are the wider consequences of this new computer? That may seem an odd question, but the Raspberry Pi has always

## INTERVIEW: Eben Upton

Eben Upton wears two hats: he's a technical director and ASIC architect for Broadcom, and he also co-founded the Raspberry Pi Foundation in 2009. As CEO of Raspberry Pi Trading, too, it makes him a very busy man, but he took time out to answer our questions.

**Micro Mart:** What possibilities does the Raspberry Pi 3 now bring to the Pi community?

**EU:** There are three things. The Raspberry Pi 3 brings more CPU performance, which makes the device a much more credible PC replacement. Wireless LAN and Bluetooth also mean that in the PC-replacement role you can be almost completely wireless (you only need a power and HDMI cable). Finally, wireless LAN and Bluetooth allow us to act as an 'IoT hub', aggregating the output of numerous low-cost sensors and uploading the data to the cloud.

**MM:** Which features of the Raspberry Pi 3 do you consider most crucial, and why have they only become viable now?

**EU:** The wireless features are the real headline in this generation. They've become viable due to incremental reductions in component and manufacturing costs, and because we now have a large enough engineering team at Raspberry Pi to take on the burden of wireless design and conformance testing.

**MM:** What are your hopes for the Pi at this stage?

**EU:** Our dream was originally to get back to the level of involvement in computing that we saw in the 1980s, but since then we've become more ambitious. You have to remember that only a very small, privileged, segment of the population had access to a high-quality computing and engineering education then. The opportunity is to go beyond that to the point where all young people, in the UK and overseas, have the opportunity to become engineers.

**MM:** What would you like to see in a Pi 4?

**EU:** I'd prefer not to speculate at this stage, other than to say that of course we'd want faster CPU cores!

**MM:** How well is the Raspberry Pi Zero doing and has it exceeded expectations?

**EU:** It's doing well. I think we underestimated the level of demand. We're ramping up production nicely now (subject to the constraints imposed by building lots of Raspberry Pi 3 units at Sony in Wales), and hope to catch up with demand in the next couple of months.



been more than a machine. It's underpinned by a mammoth educational, charitable organisation with a huge drive to promote computer science. It has 60 full-time employees, its own official magazine and training programmes for teachers. There's a £1 million education fund, which has been running for a couple of years, looking for projects that benefit children



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- » Easy pair from network to Bluetooth or physical connection (AUX)



aged between five and 18. It seeks projects that make use of computing technology either in and of itself or within STEM subjects and the creative arts.

Asking how the Raspberry Pi 3 will affect education is therefore valid, and the answer is that the computer will provide a pleasant boost. Producing new computers such as the Raspberry Pi 3 and the Raspberry Pi Zero – as inexpensive as they are – help to generate a small profit that can be used in such enterprises. A new release keeps the interest peaking and, as the £4 Zero in particular proved, has the potential of catching the eye to such a degree that it can become big, global news.

This is one of the major reasons why, regardless of the lack of an amazing shift forward, you should seriously consider an upgrade. The more the Pi sells, the more chance there is of educating greater numbers of teachers and pupils. In that sense, buying a Pi 3 is an

### Raspberry Pi 3 Specs

**SoC:** Broadcom BCM2837

**CPU:** 4x ARM Cortex-A53, 1.2GHz

**GPU:** Broadcom VideoCore IV

**RAM:** 1GB LPDDR2 (900MHz)

**Networking:** 10/100 Ethernet, 2.4GHz 802.11n wireless

**Bluetooth:** Bluetooth 4.1 Classic, Bluetooth Low Energy

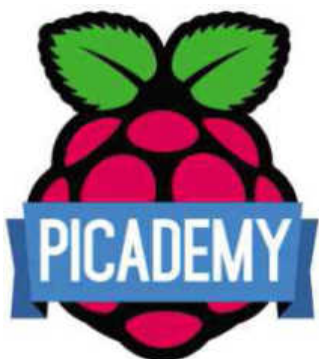
**Storage:** Micro-SD

**GPIO:** 40-pin header, populated

**Ports:** HDMI, 3.5mm analogue audio-video jack, 4x USB 2.0, Ethernet, Camera Serial Interface (CSI), Display Serial Interface (DSI)

investment in our children's future as much as in a piece of hardware for yourself. It's all very much win-win: users get powerful, small computers that they can use to stretch their minds and understanding, and the foundation gets the money it needs to keep pushing the learning aspect of its remit.

At the same time, there is an inherent danger in constantly moving forward. As the Raspberry Pi becomes more powerful, it becomes vital that teachers are able to keep up. It's already





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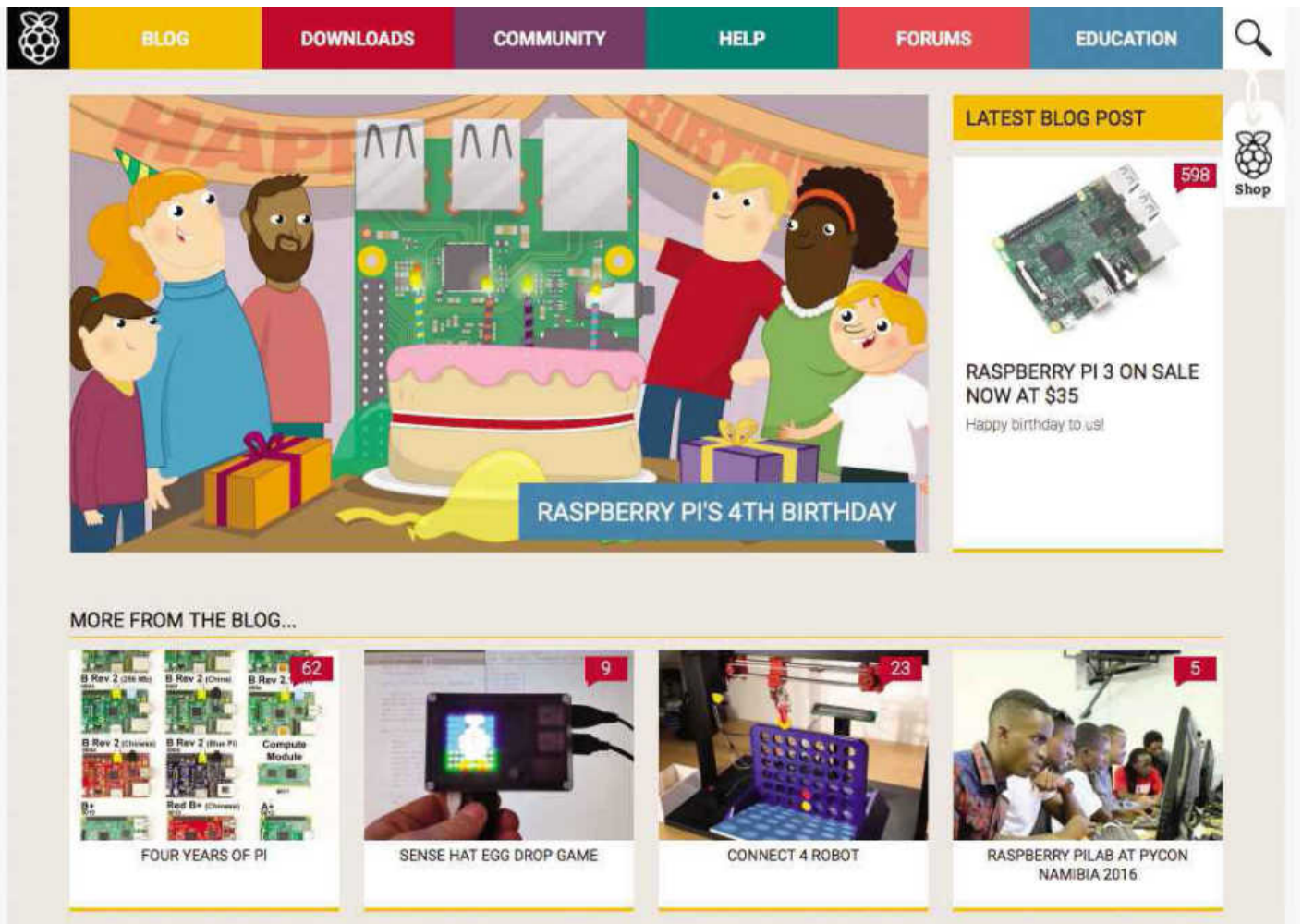
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been a long process to get to this point, and no one wants to risk derailing the process so early on.

To explain, when it was announced in the UK that the ICT curriculum was being torn up and replaced by a computing subject, it scared a good number of teachers. They were used to showing children how to use the tools that had been created by others but not so hot on how those apps were developed in the first place.

There was also a great deal of anxiety that their pupils may well know more than them, but the Raspberry Pi Foundation was able to step in at the right time and not only bring educators up to speed but show that fostering an environment of mutual learning in the classroom could be widely beneficial to all sides.

Over the years, Picademy has runs dozens of workshops for teachers and suggested projects they can try. There has been a strong tie-up with Code Club and an emphasis on what the Pi Foundation refers to as the “maker approach”. These kinds of programmes are important if teachers are going to be able to continue their work, but the key is for the Pi Foundation to keep the education and the roll-out of new machines in step – something that requires ongoing funding and effort.

If the Raspberry Pi becomes too advanced, some retraining of those who have already gone through the process may be necessary. There is also a risk of making the machines appear too complex. There could well be a line that the Pi crosses at some stage in the future, which starts to move the computer

“ This is the first Pi you can stick behind your TV and completely forget about ”

further and further away from its core aims without being able to bring teachers up to speed in time. That time hasn’t come yet, though.

### Well Intentioned?

Is the greater good really a reason to spend 30 notes on a new computer? To some degree, yes. In an interview with a leading gadget magazine, Upton said the UK government had declined to provide funds for the Raspberry Pi project a couple of years before it was launched, which is a pity. It appears the government believed there was no market for the computer, and the door to that particular revenue stream appears to have been closed ever since. There’s still a technology skills shortage, and computers such as the Raspberry Pi 3 help to form bridges over the gaps and foster learning among the young. If that’s not a reason to buy, we don’t know what is.

Of course, the more money that’s invested, the greater chance of the Pi being enhanced in the future. Upton has

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## Ingredients For A Pi

The idea for the Raspberry Pi was formed almost exactly ten years ago when Eben Upton, a lecturer at Cambridge University, was finishing his PhD and realised that the A-level students he had been asked to interview for the Computer Science degree were severely lacking the level of knowledge of their predecessors.

He realised that a generation of children were dropping down an educational hole in terms of computing and he felt that most teaching of IT tended to revolve around familiarising students with Microsoft Word and Excel rather than programming. This approach, combined with the fact that the glossy front-ends of computers had persuaded people not to tinker 'under the hood', got him thinking.

Having been brought up hacking and programming on his BBC Micro, he felt that making a similar system available for children today would be hugely beneficial. As luck would have it, he wasn't the only person thinking of solutions to the same problem. His friend Jack Lange, a demonstrator at Cambridge University's Computer Laboratory, also noted the problem, and David Braben, the joint coder of the space trading game *Elite*, was rocked by children who found ICT to be the most boring subject at school. Computer science applications were substantially dropping even though the university population was rising. Something, they all surmised, needed to be done.

Initially, they considered producing a software platform; they also thought about snapping up lots of retro computers and flooding schools with as many as they could find. But neither were seen as ideal, and the latter, in particular, would have led to the secondary problem of having to share computers. It would be natural for a select few to start hogging the machines and leaving others behind. The solution was to produce an inexpensive bare-bones machine that could potentially be handed to every child.

Upton began to crack on. He produced a few prototypes, his first an Atmel Atmega644 microcontroller-based platform that ran at 22.1MHz and had 512K SRAM for data and framebuffer storage. Colleagues Rob Mullins, Alan Mycroft and Lang helped, Braben got on board, and they touched base with Pete Lomas, who was the managing director of hardware design at Norcott Technologies. In 2008, a charity that became the Raspberry Pi Foundation was formed to promote basic computer science in schools.

The fact Upton began working for Broadcom went in the group's favour, because they were able to get a good supply of cheap chips. They used Broadcom's system-on-a-chip, which is designed for phones, but as much as the hardware was important for encouraging children to be curious and inquisitive, the software had to be right too. They went for an open source OS – Linux – which also cut costs, and they encouraged programming in Python and Scratch.

With the hardware and software coming along, they visited the BBC and tried to persuade the Corporation to put its name to the machine. Technology correspondent Rory Cellan-Jones was rather taken by it and made a video with David Braben holding the computer, which went viral. The BBC didn't lend its name to the machine in the end, but the publicity was enough to reaffirm the Raspberry Pi Foundation's conviction. Two models were worked on: Model A and Model B with their varying RAM, USB ports and Ethernet (or not).

The Raspberry Pi was launched on 29th February 2012, and the first production batch of 10,000 units sold out within hours. It led to massive delays and caused a lot of stress, but it also helped to increase the hype and publicity around the machine. Since then, schools and hobbyists have taken the Pi to their hearts and there have been two further major iterations, together with a small-form Raspberry Pi Zero. Everyone, it seems, has wanted a slice of the action.



already said that features will be added to the Pi if they can be done so without affecting the overall cost of the product, and some of those wouldn't pose a problem to learning. A switch to USB 3.0 would not perplex youngsters or teachers, for instance, and neither would the addition of extra RAM.

For now, though, the Raspberry Pi 3 continues to allow people to delve deep into their machines. It's a computer that shows how the processes work and how coding can achieve all sorts of weird and wonderful outcomes. Some people have suggested making the Pi powerful enough now for a full-blown Windows 10 to be installed, but that's going back to

the initial problem of creating computers for consumers and not developers. While that could be good for people who are simply after a cheap workhorse, it's not really what the foundation founders were thinking ten years ago.

So yes, buy a Raspberry Pi 3 and enjoy the extra benefits it brings. Use it to produce projects that equal or better those we looked at a few issues ago. The Raspberry Pi 3 delivers two things that people have wanted for a long time – speed and connectivity – without going crazy and adding any perplexing technologies. It tastes as good now as it always has. [mm](#)





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# An SSD For A Fiver

**Psst! Want a cheap SSD? Let  
Leo Maxwell show you how**

**B**uying an SSD for £5 may seem far-fetched, but it is possible. They're usually in a non-standard form factor, often as uncased PCBs. Many of these SSDs are intended for use in printers or other devices. Therefore, they're designed for reliability and low latency. In addition to a fast read/write speed, they offer a small physical footprint, coupled with silent, low-power operation – useful attributes for many applications. As long as they have the standard SATA connections, they should work in a PC without problems. They can also be found to fit PCIe or mSATA slots.

Of course, they don't have a massive capacity, and while there are ways to reduce the size of a Windows installation, the minimum currently required is around 60GB, which still costs £25 or more at the moment. Linux, however, is a different story.

An SSD can make a real difference to a PC's responsiveness, but most of the speed benefits apply to loading applications or large data files such as high-resolution images.

I first had the idea when I was building a small PC which was intended mainly to function as a network TV and media server, but with occasional local use for web browsing and other routine



tasks. For the latter, I decided that it might be nice to have the responsiveness of an SSD.

A media server needs lots of storage, and SSDs in the terabyte range still demand a sizeable price premium compared to their mechanical cousins.

Video recordings, especially in HD, require quite a lot of disk space, but the network imposes a far narrower bottleneck than any disk I/O, so read speed is not really an issue when streaming. It's also a good idea to limit write operations on an SSD. Recording operations, particularly pausing LiveTV, involve almost constant disk writes.

Using a small SSD for the operating system and a large mechanical drive for storage meant that I could get the responsiveness of an SSD for the OS operations while keeping down the overall costs.

I obtained a brand new 8GB SLCmode SSD for £5 plus £1 postage. It was about a quarter of the size of a traditional 2.5" drive.



## Making It All Fit

Of course, making use of one of these as the main drive for a PC requires a little planning.

Even a standard Linux distro can easily fit in 8GB or less. Depending on application, that might well be enough. For example, it would be ample for an internet gateway or a DIY NAS.

For a media server or desktop system, however, there are three locations that could be a problem.

### /swap

In Linux, virtual memory is supported by the swap partition, which is the equivalent of the Windows pagefile. The recommended size for a swap partition is twice the size of available RAM. As I had 4GB of memory, this would have used my entire SSD. A Linux system with 4GB of memory or more may never actually use swap. In fact you may be able to dispense with it altogether if you wish, as it's mainly used to support suspend and hibernation modes.

### /home

The home partition holds all of the user's data. This comprises configuration files, internet cache, images, documents, emails and videos etc., and it can grow quite large. It's also where downloaded files usually arrive. As I intended to occasionally use this as a desktop system, it would probably become too large for the SSD.

### /var

This is where all of the system's variable data lives. In here are log files, spool files, the apt package cache and many more small, frequently changing files, which makes it a bad candidate for an

SSD anyway. Many applications also keep a cache or store their data in here. MythTV, the main application for my distro of choice, Mythbuntu, uses /var to store gigabyte-gobbling media files.

I also use a program called Zoneminder for managing Security cameras, which likewise defaults to this location for image and video storage.

Of course, with Linux you can have many different partition schemes, but I finally decided to use the 8GB SSD as /, the root drive, and put three partitions on the hard disk. These were an 8GB /swap partition and a 40GB /home, leaving about 950GB for /var, where the bulk of the data would reside. To do this, select custom partitioning during installation.

“ An SSD can make a real difference to a PC's responsiveness, but most of the benefits apply to loading applications or data such as high-resolution images ”

## Making It Work Better

In operation, my system is nice and responsive, despite running on a fairly low-power AMD AM1 Kabini MiniITX system. However, there are some tweaks you can apply to make it even better.

## Choose The Right Filesystem

Unlike Windows or Macs, Linux can make use of many filesystems, and there are many opinions as to the best for SSDs.

Ext3 and Ext4 are the most common choices. They are both journaled filesystems, which means that they record each change before they make it. Although this makes them more reliable in the case of a crash or power failure, it does increase the number of write operations. Other filesystems such as Ext2 do not do this. By and large, the extra writes are tolerable because they increase reliability. Btrfs is another filesystem, which has additional optimisations for SSDs.

Ext4 is the default for most distros these days, and it supports Trim.

## Enable Trim

Many distros enable Trim by default. To see if an installed filesystem on an SSD supports Trim, you can run it manually in a terminal by typing: `sudo fstrim /`

If you get the error 'fstrim: /: FITRIM ioctl failed: Operation not supported', then your filesystem does not support Trim.

Trim releases unused sectors and is executed daily by default in many distros, but only for recent filesystems such as Ext4, and only for Samsung, OCZ, Patriot, SanDisk and Intel drives.

There are several reasons for this, but you can force trim (for supported filesystems) for other makes of drive.

First, we need to back up the file we'll be editing.

To do this, in a terminal, type: `cp /etc/cron.daily/fstrim /etc/cron.daily/fstrim.bak`

To edit the file, we'll be using nano, which is a user-friendly command-line based editor. It has the advantage of the commands being displayed at the bottom of the screen.

## “ Even a standard Linux distro can easily fit in 8GB or less ”

In a terminal, type:

```
sudo nano /etc/cron.daily/fstrim
```

Use the cursor keys to move around, backspace or delete to edit lines, and Ctrl+o to save, followed by Ctrl+X to exit.

Edit the line that starts 'exec fstrim-all' to read 'exec fstrim-all – no-model-check'.

This method is to be preferred to setting dynamic trim by adding the discard option in fstab entries, which can cause slowdown on current kernels.

### Prevent Datestamping

atime is the access time option. When enabled, this means that the datestamp on each file is updated every time it is accessed, which adds to unwanted writes. It can be disabled by editing the /etc/fstab file entry for the SSD.

To edit the /etc/fstab file, first back up the fstab file in case of problems, using the following command:

```
cp /etc/fstab /etc/fstab.bak
```

Then to edit it:

```
sudo nano /etc/fstab
```

Now, make the following changes to each SSD drive entry.

If relatime is present, remove it, and add noatime. The entries may look like this:

```
/dev/sda1 / ext4 relatime,errors=remount-ro
0 1
```

...or this:

```
# / was on /dev/sda1 during installation
UUID=77d591aa-23d0-4470-9c67-06295454be7a /
ext4 relatime,errors=remount-ro 0 1
```

Either way, edit the options separated by commas like this:

```
noatime,errors=remount-ro 0 1
```

### Move System Cache To RAM

While we're looking at the fstab file, there's another change that can be made. The system cache is stored in /tmp, which is in root. By default, this is flushed on every boot. If you have 4GB or more of RAM, it can be moved to RAM, which reduces disk writes and improves access times.

Add this line to the bottom of the fstab:

```
tmpfs /tmp tmpfs defaults,noatime,mode=1777 0 0
```

Save the fstab file and reboot to apply these changes.

### SSDs: A Short Guide

SSDs have changed immensely over the last few years. For example, 'wear levelling' ensures that writes are applied evenly over the memory cells, and initial problems with drive partitioning and operating system incompatibilities have been overcome. Prices have dropped steadily, while capacity has increased.

Of course, what follows is grossly simplified, and there are many other factors that can affect performance and longevity. As the market develops, new ways of optimising memory cells are emerging. Firmware in controllers and software in operating systems continues to improve, as do manufacturing processes.

There are currently three main types of SSD: SLC, MLC and TLC.

#### SLC

These are single-level cell devices, which means they store one bit of data per memory cell. This gives higher sequential and random data read and write speeds, faster access times and a longer life for the device, as they can tolerate a larger number of write operations. This comes at a cost, however, which means they're mainly used for enterprise applications in servers.

#### MLC

MLC stands for multi-level cell. Most SSDs sold for general use are MLC. In these devices, the voltage output level of each cell can be used to represent more than one bit, enabling it to store two bits per cell. This reduces the manufacturing costs but slightly reduces read/write speeds and increases access time. The life of an MLC device is roughly two thirds of that of an SLC device, which is still about four times that of a typical mechanical hard drive.

#### TLC

TLC devices use triple-level cells, which reduces the price further, but at the cost of lower speeds and a shorter life.

#### Mixing It Up

In addition to these basic forms, hybrid devices use a mix of these three types of memory cells.

SLC SSDs have cells that can be flipped between SLC and MLC modes depending on storage requirements, essentially operating as SLC until the drive starts to fill up past the 50% mark. This increases speed and lifespan, while still keeping the costs down. These are often used for embedded applications, such as in printers, where the full capacity is seldom used. I purchased one of these, which was ideal for my choice of OS.

There are other types of hybrids emerging. For example, some use SLC for a high-speed cache and TLC for longer-term storage.

Other types of solid-state memory worth mentioning are SD cards and eMMC (Embedded MultiMediaCard). Most phones, tablets, and Chromebooks (including convertibles often sold as laptop replacements) use eMMC modules for storage. They're more like SD card memory than a true SSD. Although they're faster than a mechanical drive, SD cards are slower than a true SSD and are not as well suited to the frequent write cycles of a typical PC.



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## Change The Scheduler

Another option that can help with efficiency is changing the I/O scheduler. The default scheduler in Linux is CFQ (completely Fair Queueing), which is designed to deal with hard drive latencies, but there are two other schedulers in the kernel: NOOP and Deadline. NOOP is not really a scheduler, just a basic FIFO queue, but Deadline prioritises reads over writes, which can give a more responsive system for desktop use.

To find out which scheduler is in use (assuming your SSD is sda), type:

```
cat /sys/block/sda/queue/scheduler
```

You should see something like this:

```
leo@Mainbox:~$ cat /sys/block/sda/queue/scheduler
noop [deadline] cfq
leo@Mainbox:~$
```

To change this setting, edit the rc.local file:

```
sudo nano /etc/rc.local
```

Add these two lines above the 'exit 0' entry:

“ **The life of an MLC device is roughly two thirds of that of an SLC device, which is still about four times that of a typical mechanical hard drive** ”

```
echo deadline >/sys/block/sda/queue/scheduler
echo 1 > /sys/block/sda/queue/iosched/fifo_
batch
```

If you want to use noop, add this line:

```
echo noop > /sys/block/sda/queue/scheduler
```

If you have more than one SSD, you can add a line for each one, just change sda to sdb or whatever the SSD is.

This last edit may need to be reapplied after a system upgrade.

## Keeping It Tidy

Of course, running in such a small space requires some housekeeping to ensure that the root partition does not fill up, as this will cause the PC to slow to a crawl and eventually shudder to a halt.

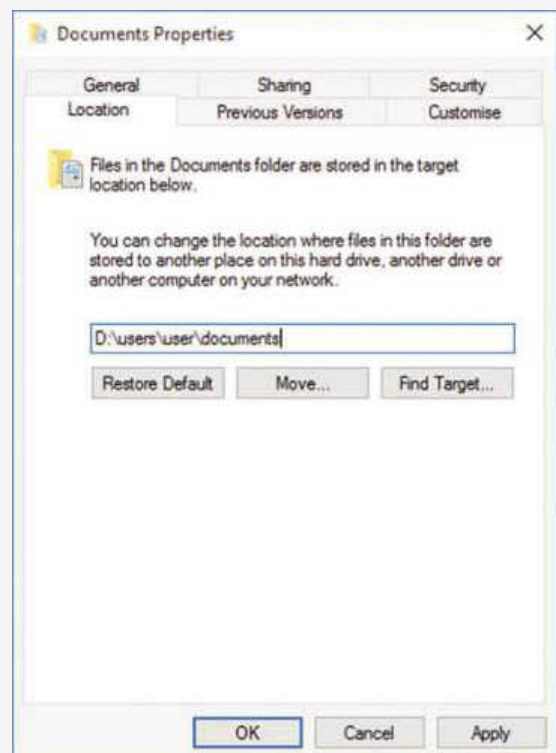
Having /var on a large partition of its own eliminates the common problems of log files and apt cache growing to fill the root partition, but it's still worth keeping an eye on the size of /var/log and cleaning the apt cache periodically with 'sudo apt-get clean'.

## The Windows Option

Although Windows has a larger OS footprint, there are ways to reduce this considerably. These include removing programs that aren't required and moving personal folders, which can take up a lot of space. Such measures can reduce the basic OS footprint to below 30GB, so a 60GB SSD should be ample.

Because the location of most system folders is listed in the Windows registry and some programs have these locations hard-coded in, they cannot be moved by conventional means or by using a standard shortcut. Instead they need to be redirected using symbolic links. For redirecting personal system folders, Windows has had a built-in procedure since version 7

1. Windows 7: Open the Start Menu and click on your user name. This will open your user folder. In Windows 8 or 10, open Explorer and click on your user name.
2. Right-click a personal folder that you want to move to another location.
3. Select 'Properties'
4. Click the 'Location' tab.
5. The dialogue box shown below will open.
6. Click 'Move'.
7. A dialogue 'Select a destination' will open.
8. Browse to the location where you want to move this folder. You can select another location on this computer, another drive attached to this computer or another computer on the network.
9. Click the folder where you want to store the files (Note: not the root of a drive).
10. Click 'Select Folder'.
11. Click 'OK'.
12. Click 'Yes' to move all the files to the new location.





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## Remove Unused Or Orphan Packages

Applications take up space on the root drive, so don't install anything you don't need, and remove anything you don't use.

Running `apt-get autoremove` with no parameters will remove any orphaned dependency packages.

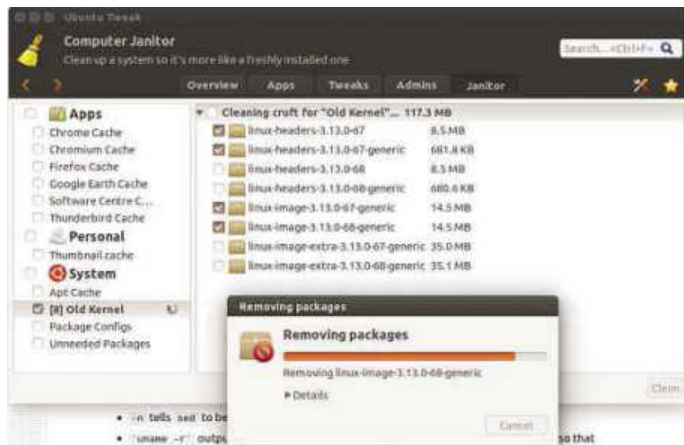
These are programs that were installed to support another application, which are no longer needed, usually because that application has been uninstalled or updated and the new version no longer needs them.

## Remove Old Kernels

A kernel will consume approximately 120MB of disk space. When you update the kernel, most distros will keep the last one or two in case of problems, but some do not delete any automatically.

If you ever compile drivers or applications, then you may find that the old kernel header files are also retained.

To find out which kernel you are currently running, open a terminal and type `uname -r`. My current kernel is 3.13.0-71-generic. Do not remove the current kernel, or your system won't boot!



To find out which kernels you have hanging around, type:

```
dpkg -l | grep linux-image
```

this will list all of the currently installed kernels. You may be surprised how long the list is!

I once found 86 kernel packages along with their headers, or approximately 3.4 GB of files.

There are several ways to remove old kernels. If there a lot, it may take some time.

◀ Not all system folders can be redirected this way. These system folders located under `Users\<User name>\` have a 'Location' tab in their properties sheet and can be moved:

- Contacts
- Desktop
- Documents
- Downloads
- Favourites
- Links
- Music
- Pictures
- Saved Games
- Searches
- Videos

OneDrive understandably does not.

If you want to return a folder back to its original location, you can use the 'Restore Default' in the 'Location' tab..

Note: Moving individual data folders like this is okay, but moving the main user folder can cause problems with some software and upgrades..

There are other ways to reduce the Windows footprint, but that would require a completely new article.

1. Manually one at a time using `apt-get`, e.g. `sudo apt-get autoremove linux-image-3.13.0-24-generic` (the autoremove option removes dependencies that are no longer required, such as the header files)

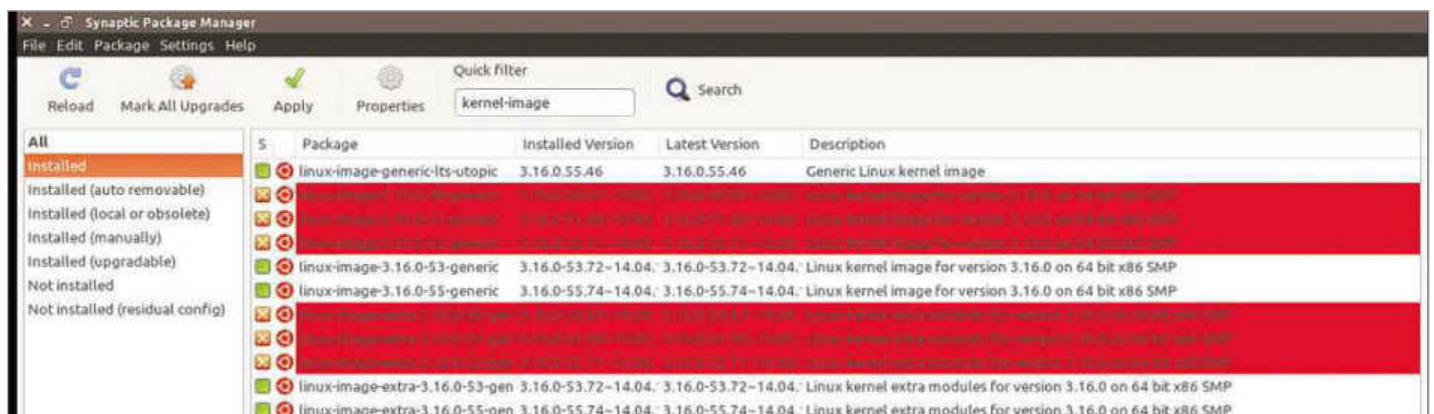
2. Manually using your package manager of choice, e.g. Synaptic or the Ubuntu software centre.

3. Ubuntu Tweak. Obviously this only works for Ubuntu, but it is a very useful tool, download it from <http://ubuntu-tweak.com/>.

## What Next?

This was an interesting project, and no doubt there are many other applications for this sort of device.

Anywhere where a small, low power unit is required to house an OS with a small footprint, such as internet gateways, DIY NAS, routers, thin clients and in car PCs. **mm**





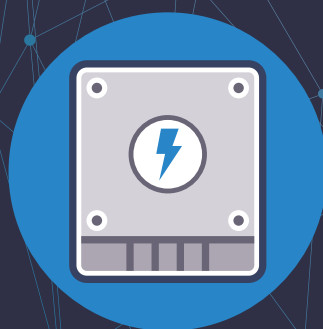


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# Feeding The Fire

**Installing Android apps  
on an Amazon Fire tablet  
increases its usefulness, as  
Chris Salter demonstrates**

**A**mazon's phone was never a runaway success. It was released in July 2014, but Amazon kept dropping the price, before it stopped selling the device in August 2015, with no follow-up announced.

However, that hasn't stopped it with the Fire tablets. Amazon released the first Kindle Fire tablet in 2011 (a 7" tablet), running a modified version of Android called Fire OS. Since then, Amazon has increased the Fire range to include different sizes, ranging from 6 inches all the way up to 10 inches.

At the end of September 2015, Amazon released the cheapest Kindle yet: the third-generation Fire (although the Kindle states it's a fifth-generation Kindle Fire in the settings, as this counts the other Kindle Fire tablets, such as the HD range). The device costs £50, which is significantly cheaper than the majority of the its competitors. Usually device costs are slashed by offering underpowered and poor performing tablets, but with the Fire, this isn't quite the case. While the specifications are nothing to shout about, they still provide a reasonable experience in use, in comparison to some of the cheap Chinese-made tablets running Android.

Amazon uses the devices to help sell its Prime service. By getting an Amazon tablet, you have a device that has easy access to all of Amazon's prime services, such as TV and film streaming, books, music, cloud storage and, of course, Amazon shopping.

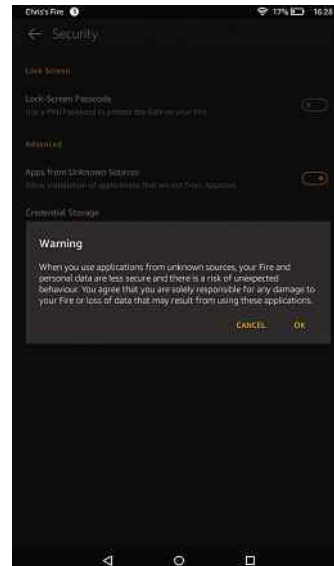




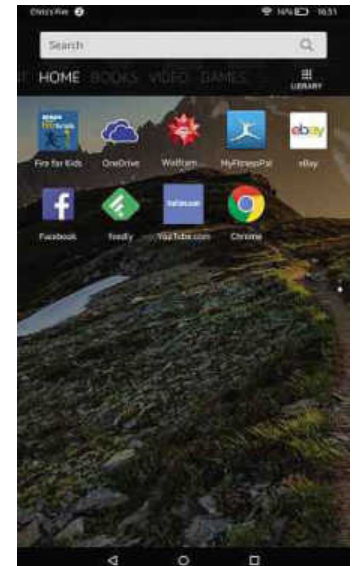
▲ Adverts appear on the lock screen of the Fire



▲ The Kindle book page



▲ Turning on side-loading gives a warning that it can allow malware to be installed



▲ Home screen showing installed apps, including side-loaded apps

It's easy to see that Amazon can make the device a loss leader to get you into the Amazon ecosystem and still make its profit by convincing you to purchase its other services.

The hardware itself is quite sturdy. It is all plastic construction; you aren't getting the nice metal finish of the iPad, but the Fire costs a fraction of the price of an iPad.

## Fire OS

Fire OS is a customised version of Android specifically for the Amazon range of tablets. One drawback of the Amazon tablets is that they're missing the Google Play store, along with other core Google services, such as Calendar, Mail and Chrome. This means that if you use an Android phone, then the Amazon tablet will not be able to use the apps you already have or purchased from the Play store. The Fire tablets use the Amazon App store instead. This can be accessed from the Amazon website, as well as on the tablet so you'll be able to investigate the applications available before making a purchase of a tablet, though this is as well laid out as Google's store. Most big name applications are in the Amazon app store, such as Facebook, Netflix and iPlayer. However, there are some notable exceptions, such as Dropbox and all the Google apps. Perhaps with these cheaper tablets and a greater proliferation of Amazon tablets running Fire OS, some of the more popular applications may consider entering the Amazon app store.

However, because Fire OS is a customised version of Android, you can install some Android apps by side-loading them. Side-loading is installing software onto the device that is not found within the app store by using the Android installer files (.apk files). By default, the Fire (and most Android devices) have the ability to side-load apps turned off, as this is a vector for malware to be installed on the system. However, it can also be safe to use if you know that it poses a potential risk to the security of the tablet.

It should be noted that installing apps by side-loading seems to ignore the ability to install to micro-SD card, so you will be limited by the 5GB free space that the Fire has. However, you can install apps from Amazon's store to the SD card by enabling the setting within the options to allow compatible apps to be installed to the SD card to help keep the main device space free for any side-loaded apps. Another downside to side-loading apps is that you

“ Because Fire OS is a customised version of Android, you can install some Android apps by side-loading ”

lose the ability to auto update apps, because they aren't being checked within the Play store (not installed) or Amazon store (as they aren't in the store) for updates. Therefore, you'll have to manually update the apps as and when required. For some apps, this might not be an issue, but for apps that update regularly, this might become a chore.

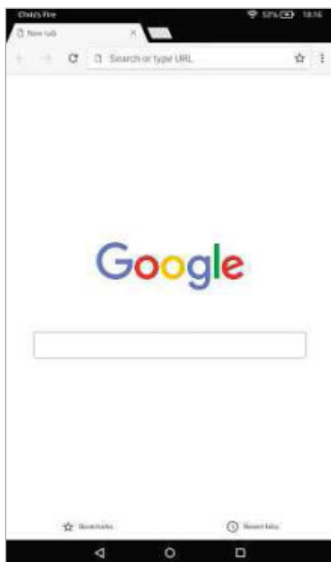
Side-loading apps is as simple as getting the .apk files onto the Kindle and installing them. However, you need to get hold of the .apk files, and you need to be able to browse the file system on the Kindle to install them.

## Procedure

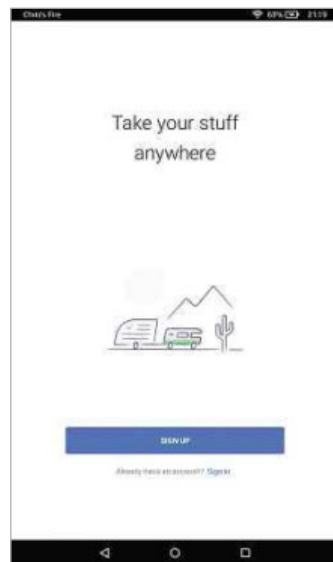
Firstly, you need to get hold of the .apk files. This can be done in a number of ways. You could browse the internet for them and download them from various locations around the web. However, this is perhaps an easy way of getting an infected app, as people might edit the original .apk file to include malware. The best location to get them from is the Google Play store directly. To prevent malware being inserted, Google doesn't just let you download the .apk files themselves, so you need a workaround to get hold of them.

## Specifications

Screen: 1024 x 600 (171 pixels per inch).  
CPU: Quad-core 1.3GHz ARM Cortex A7.  
RAM: 1GB RAM.  
Storage: 8GB.  
Support for 128GB micro-SD card.



▲ Google Chrome installed and open on Amazon Fire



▲ Google Chrome asking you to sign in; it won't work without the Google Services installed

If you have an Android phone already, then you have an easy access method of getting the .apk: you can download the app to your phone and then extract the file from the phone. Alternatively, you can use the device ID with a browser extension on a desktop to download the files as needed.

You'll need to download an application from the Amazon app store to get started – a file explorer to view the underlying Android filesystem. I used ES File Explorer ([goo.gl/C5jf5F](http://goo.gl/C5jf5F)) for this article.

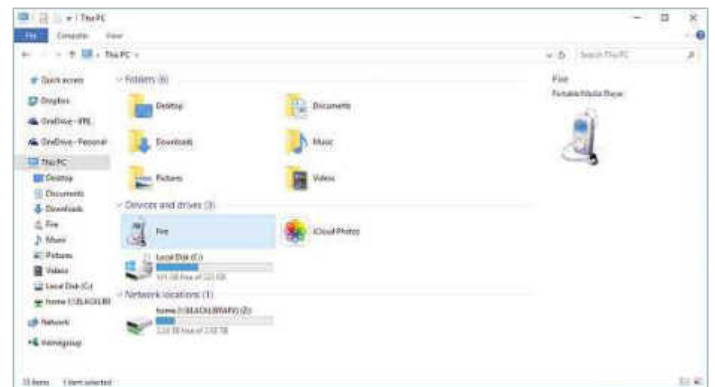
## Phone Backup Method

One of the easiest methods is to get the app from your phone already or download the app to your phone and then transfer it to the tablet. For this, you'll need to download a backup app; I used Super Backup by Mobileidea Studio ([goo.gl/gHVEUm](http://goo.gl/gHVEUm)), because it can save the .apk files to the micro-SD card. Note that, by default, it'll back up every app as and when they're updated, so your micro-SD card could fill up with every single version of every app that is updated! If you don't want this to happen, you can choose to disable it in the settings. However, one of the downsides to side-loading apps onto the Fire tablet is that they aren't automatically updated, since they don't have access to the Play store, so this auto backup behaviour may be something that you want to keep in mind. Team it up with BitTorrent Sync, and you'll be able to sync the new versions of the .apk files directly to the Fire tablet (there's a version of BitTorrent Sync in both the Play and Amazon app stores).

Open Super Backup and you're presented with a list of items to back up. Select apps. If your device is rooted, you can back up all the app data as well as the included .apk file, but if not,

## Adverts

Part of the reason for the low price of the tablet is that Amazon displays adverts devices on the lock screen for services, apps and other items it sells. These can be removed by buying the tablet from Amazon for £10 extra or from speaking to Amazon support afterwards (also for a £10 fee). It's personal preference if this bothers you.



▲ The Fire appears as a media player within Windows

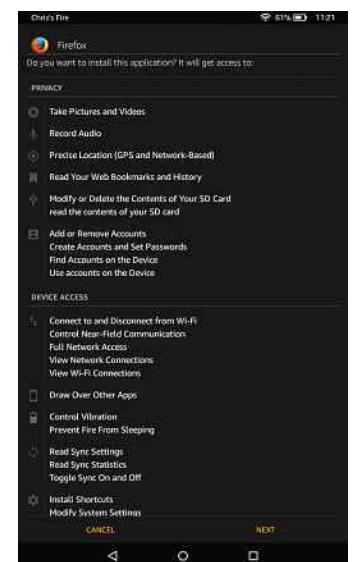
you can only back up the .apk itself. This is saved to a folder on your phone or micro-SD card (change this within the settings). This provides you with an .apk file that you can now transfer as you please to whatever cloud service or machine you want to use. Based on the Android version of your phone, you may or may not be able to change the location of the backups to the micro-SD card.

The best way I found to move the files from my Android phone to my Kindle tablet was to use OneDrive – Microsoft's cloud storage service. This is on the basis that it would allow me wire-free access (I didn't have to be sat at my computer to move an app across) but, importantly, OneDrive has an app in the Amazon app store, whereas services like Dropbox or Box don't. If you can use OneDrive, you could then switch back to a cloud service you use regularly by side-loading the Android app from the Play store, but you would need OneDrive to start with. Of course, you could use a USB cable and your computer to side-load the apps (or perform an initial side-load of say, the Dropbox app).

To import the .apk files using a USB cable and laptop, I backed up the apps using Super Backup and connected my phone to my laptop. This let me browse the files on my phone, and I was able to copy them off the micro-SD and onto my laptop. It may require some playing about; I had to connect the device as a camera (PTP) and have the .apk files in my camera folder to be able to see them. Once downloaded to your



▲ Remove the micro-SD card and apps get greyed out and will need to be reinstalled



▲ On installing, you're still presented with a list of permissions the app needs



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▲ **APK Downloader** presents a log in screen for you Google username, password and DeviceID

computer, you can then upload them to the Kindle (I had no issues moving them to the Kindle).

Once the .apk devices are on the Kindle, open up ES File Explorer and browse to where you saved the files. Click on the .apk file and select install. This will give a scary-looking screen showing the permissions that the item requires when it's installed. If you agree with this, then carry on with the installation and it'll install for you. You can now use the app from the main screen.

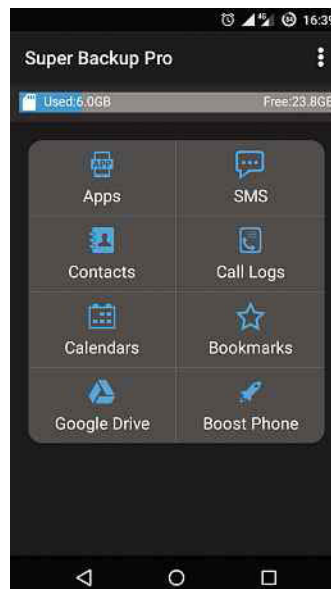
## “ It's always preferable to download apps from the Amazon store where possible ”

Note that some of the apps that require Google services (such as Chrome), won't work correctly unless you're able to copy across all the Google services as well.

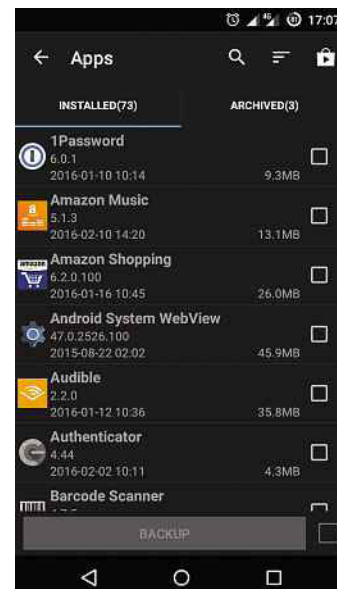
### Browser Plugin Method

You can download .apk files directly from the Play store using a browser plug-in for either Chrome or Firefox. Google would prefer you not to access the app store this way, hence why it doesn't allow you to download the .apk files directly. The extension is called APK Downloader and lets you download the .apk directly to your laptop, allowing you to transfer the .apk file as described as above. The main drawback to this method is that you need a Google account to associate purchases on the Android marketplace and that it requires an Android DeviceID to work as well.

The Android device ID is so that the store can log what device the app is to be installed on (though we aren't going to actually install it on that device). If you've already got an Android phone, you can use the same device ID. You can find this by either downloading the Device ID app ([goo.gl/ymrN7r](http://goo.gl/ymrN7r)) or dialling \*##8255\*##. I found that on my device, I had to use the app. Once you have this information and the email and password of your Google account, you can visit the Play store via the browser and you now have a button on the app store, letting you download the .apk directly to your computer rather than the device. You can then follow the same method of installing as above.



▲ **Super Backup** allows you to backup apps, amongst other items



▲ **Super Backup** shows all the installed apps on your Android device

## Non Android Users

Unfortunately, non-Android users are perhaps a bit stuck – without an Android device to download the apps to initially or being able to use a Device ID number to use the browser plug-in, you're restricted to either downloading the .apk directly from sources on the internet, if you can find it, or getting your Android-running mates to download it and send you a copy of the .apk.

There are websites that offer .apk downloads, but side-loading is an easy way to get an infected app. The best option is if you can get a friend to send you an app or even get a cheap Android phone off eBay and use the Device ID to go down the route of the browser plug-in (as the app store may prevent you downloading directly to the device if it isn't compatible).

## Conclusions

It's always preferable to download apps from the Amazon store where possible, because Amazon will be able to auto update these and, where possible, apps from the Amazon store can be downloaded to the micro-SD card, freeing up space on the small internal drive.

But side-loading allows you to use apps that you might have paid for in the Play store, so you don't have to purchase them again in a second store. Note that the methods of downloading the .apk files detailed here will not allow you to pirate apps, but if you've already bought and downloaded the app, you can use it on Android and Amazon devices. [mm](#)

## Malware

Side-loading is generally not recommended, because it's an easy way for malware to be installed onto Android systems. However, it is possible to install software safely using it as well if you use a known source – such as the Google Play store. Follow this article and turn off the ability to side-load when you're finished to prevent accidentally installing anything nasty.



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# Component Watch

**Could one of these high-end keyboards be for you?**

**T**here are people out there – and on the contributing team of this magazine – who will tell you that if you’ve never typed on a gaming or mechanical keyboard, you’ve never *really* typed. How good do keyboards really get, though? To find out, we’ve spent this week’s *Component Watch* looking at the best gaming keyboards on the market, then finding the best price possible for them. Sure, they’re expensive. Sure, they’re sometimes a little bit on the ridiculous side... But when they look and feel so good, can you really resist them?

**Deal 1: Logitech G910 Orion Spark**

**RRP: £150 / Deal Price: £119**

Logitech has long been a reliable maker of quality, low-priced hardware, so if it’s asking an RRP of £150 for a keyboard you know it’s going to be playing on the same field as some of the even more expensive ones you could avail yourself of. Romer-G switches, nine programmable buttons and multicolour backlit keys mean that this gaming keyboard more than looks the part, and we hope you’ll agree that at this significantly reduced price, it’s worth the money. We certainly wouldn’t chuck it back.

**Where to get it:** PC World ([bit.ly/1Qu5CdV](http://bit.ly/1Qu5CdV))



**Deal 2: Cooler Master Quick Fire XTi**

**RRP: £144 / Deal Price: £129**

If you think you would prefer a gaming keyboard that isn’t trying to pretend it was constructed as part of a sci-fi movie set, the slim, no-fuss Quick Fire XTi from Cooler Master is a pretty safe bet. Fear not, though, it’s still got all the features you’d want out of a high-end keyboard – four macro keys, Cherry MX Brown switches and per-key multicolour backlighting – but it’s also discreet enough that you could happily use it at work as well. That’s a combination that’s rare enough to make it worth investigating; the discount is just a bonus.

**Where to get it:** Saverstore ([bit.ly/1poW1y5](http://bit.ly/1poW1y5))



**Deal 3: SteelSeries Apex M800**

**RRP: £150 / Deal Price: £138**

Designed for speed and customisability, the Apex M800 contains QS1 switches with fast actuation times and a 3mm throw depth. The low-profile board is still compact and easy to use, though, and there’s a dedicated onboard CPU that does nothing but process keypresses to ensure there’s no ghosting – you can press 256 keys at once and they’ll all still register. Macro support and full-colour backlighting also make this a keyboard worth checking out – especially given the price!

**Where to get it:** Scan ([bit.ly/1TSxnCl](http://bit.ly/1TSxnCl))



**Deal 4: Razer BlackWidow Chroma**

**RRP: £155 / Deal Price: £135**

Razer’s gaming peripherals are always great value, and the Razer BlackWidow Chroma is no exception. Its full RGB backlighting allows for 16.8 million colours, and a 10-key rollover means you’ll never miss an input. Its custom-made microswitches have gold contacts for maximum conductivity and an anti-dust mechanism that’ll keep the interior clean where it matters too.

**Where to get it:** AWD-IT: ([bit.ly/1Qnk5dk](http://bit.ly/1Qnk5dk))



**Deal 5: Corsair Gaming K95**

**RRP: £207 / Deal Price: £155**

From the gaming hardware experts at Corsair, this mechanical keyboard features Cherry MX Brown microswitches for a top-quality typing experience, full RGB backlighting, 122-key rollover anti-ghosting and 18 dedicated G-Keys that can hold over a hundred macros. Furthermore every key is independently programmable so you can choose exactly what you want them all to do. You won’t find a better keyboard, and at this price you’d hope not.

**Where to get it:** AWD-IT ([bit.ly/1nja9qY](http://bit.ly/1nja9qY))





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## US Judge Rules Against FBI Access To iPhone

No, not THAT phone

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# HoloLens Now On Pre-Order

**Developer edition kit will cost \$3,000**

Microsoft has made quite the announcement: HoloLens is ready for developers to pre-order, so long as they're willing to stump up \$3,000. The augmented reality headset, or in Microsoft's own words "untethered holographic computer", will be released in Development Edition form on March 30th, and it's the latest virtual reality hardware announcement following the Oculus Rift, HTC Vive and, of course, the ultimately disappointing Google Glass.

These remain early days for virtual reality but Microsoft's entry into the market could prove a major draw for developers and consumers alike, although it's worth stating that there's still no word on a release date for a consumer edition.

The key features that developers can play around with on the HoloLens include HoloStudio, an application that allows users to "create 3D in 3D" at real-world scale. Kudo Tsunoda, Corporate Vice President,

Windows Experiences, Microsoft Corp, said that HoloStudio shows users how to use the HoloLens interaction model of gaze, gesture and voice and will "easily allow any developer to envision and create the holograms they need for their own applications."

There's Skype interaction with this Development Edition too, allowing people to communicate using holograms, and HoloTour offers 360° panoramic tours of places like Rome and Machu Picchu.

Finally, the game-playing capabilities of HoloLens haven't been ignored as independent developer Asobo Studio has partnered with Microsoft in the release of *Fragments* and *Young Conker*. The former is billed as a high-tech crime thriller in which "you become the detective" and life-sized characters share your space and interact with you. In *Young Conker*, which is a development from *Conker's Bad Fur Day*, we have a platformer that uses the world around you to create a unique experience every time. While it's fair to say that the reaction to *Young Conker* has not been especially positive, *Fragments* sounds – and looks – rather nice. Now, to hunt down that \$3,000...



▲ Here are the first two games announced for the HoloLens



**W**hile the world was waiting for developments in the court ruling surrounding the iPhone related to the San Bernardino killings, a US judge ruled in a separate legal case that the FBI couldn't have access to a locked iPhone. The Brooklyn judge was being asked to rule whether Apple should unlock an iPhone belonging to a drug dealer, but the judge denied the motion put forward by the US Justice Department.

His conclusion was that asking Apple to tinker with its own technology in such a way was walking on very dodgy ground – our words, not his. Here are his words, in fact: “The implications of the government’s position are so far-reaching – both in terms of what it would allow today and what it implies about Congressional intent in 1789 – as to produce impermissibly absurd results.”

On the face of it, this would appear to play into Apple’s hands as the San Bernardino-related case continues.



As we went to press, the stand-off between Apple and the FBI was no closer to being resolved. If anything, the tension between them had increased, with several leading technology companies getting behind Apple. Meanwhile, even legal professionals can't agree on who's right, with different judges coming to different conclusions.

That's not surprising, really, because this is a hugely complex case. On one side, you obviously have to consider everyone's right to privacy, as well as Apple's right to protect its security technology and its business.

At the same time, however, you can't ignore the need for national security. And who would begrudge the families of those killed or injured in the San Bernardino attack the opportunity to get some answers?

Of course, it would be helpful if the FBI had done its job better in the first place (as Mark Pickavance explains this week), but what's done is done, and I suspect this case is going to run for some time.

What are your thoughts? Write in and let us know.

*Anthony*

Editor

# Google Car Bashes Bus

## No injuries, thank goodness

**G**oogle's self-driving project is still moving along, although perhaps not as nicely as the company would have liked. It's never going to be a good day when Google execs wake up to headlines of one of its cars crashing, but sometimes these things are unavoidable.

On Valentine's Day, one of its self-driving vehicles crashed into a bus in California when it pulled out in front of it. While its vehicles have been involved in incidents before now, the significance of this particular accident is that it's the first time that one of Google's cars seems to have caused the accident, rather than being the victim of someone else's bad driving.

The report filed with the state's Department of Motor Vehicles wrote that the human

driver in the Google car assumed that the bus would slow down, allowing the car to continue on its way, and so didn't step in to override the car's autonomous mode. As the car set off again and the bus hadn't slowed down to let it pass, they had a bump.

Everyone was okay and Google has reportedly since altered the self-driving algorithm to help it understand that large vehicles are less likely to back off than other smaller vehicles might.

You can see how that could be important, can't you?



# Meanwhile... On The Internet...

**I**t's been a busy week in the world of cyber-security, encryption and politics. Our own government amended ([tinyurl.com/MMnet04a](http://tinyurl.com/MMnet04a)) – if that's the correct term ([tinyurl.com/MMnet04b](http://tinyurl.com/MMnet04b)) – the Investigatory Powers Bill in a way that appeared to award it more power than the original draft, despite the concerns expressed by three parliamentary committees ([tinyurl.com/MMnet04c](http://tinyurl.com/MMnet04c)). On the other side of the Atlantic, Apple continued to go head to head with the US government over whether it should be made to hack its own equipment ([tinyurl.com/MMnet04d](http://tinyurl.com/MMnet04d)).

This time, the two sides were arguing it out in front of a congressional committee in another round of what's becoming an increasingly bitter scrap, punctuated by moments of histrionics on both sides. Perhaps the strangest of these is a recent claim that the phone could contain a 'cyber-pathogen' that could pose a wider threat ([tinyurl.com/MMnet04e](http://tinyurl.com/MMnet04e)). This is strangely contrary to previous statements from San Bernadino police and the director of the FBI, which were far less confident about anything of any evidential value being found on the phone. Indeed, in a comment to *Ars Technica*, iPhone forensics expert Jonathan Zdziarski dismissed the claim as suggesting that "a magical unicorn exists on the phone."

Meanwhile, in New York, a judge ruled against the police in a similar case, making several points that could ultimately influence the ruling on the bigger Apple furore ([tinyurl.com/MMnet04f](http://tinyurl.com/MMnet04f)). His comments were especially interesting, as they touched on what a decision against Apple could mean for the future of surveillance. Whatever is decided in the end, it's going to have massive implications, that's for sure.

**O**ne of the first times we ever came across Reddit was in a discussion with a website creator. He illustrated to us just how big a spike in visitors the site could provide when articles are posted there, but how that was not something he could influence, due to the site's aversion to any kind of self-promotion and commitment to truly viral promotion of content. It was the first thing we thought of when we read the story of Reddit3016 ([tinyurl.com/MMnet04g](http://tinyurl.com/MMnet04g)), a parody of 'the internet's homepage', which imagines what it could look like 1,000 years from now ([reddit3016.com](http://reddit3016.com)).

The reason that conversation popped into our head is the fact that, despite claims from Reddit3016's creator that Reddit mods are removing links to his site across various subreddits ([tinyurl.com/MMnet04h](http://tinyurl.com/MMnet04h)), another version of the story could be that he is falling foul of the site's rules on self promotion. It certainly seems weird that he would both be falling foul of corporate censorship, while also being trumpeted by one of the site's

co-founders ([tinyurl.com/MMnet04i](http://tinyurl.com/MMnet04i)), but stranger things have happened... certainly on Reddit.

**I**t would appear that Netflix is making good on its recent commitment to blocking the use of Virtual Private Network (VPN) services to access its content ([tinyurl.com/MMnet04j](http://tinyurl.com/MMnet04j)). These services have become more prevalent in recent years, and highlighted the inconsistency of its content provision across the globe – a function, one suspects, of the complex licensing minefield it has to navigate with various studios and content providers.

For example, the US version of the streaming service is very different to what is available in the UK (it offers a much wider range of films and more – including vintage *Doctor Who*, we're told). And it's preferred by many Brits to our native offering. However, while early efforts to stop online border hopping met with mixed success, a recent post on Reddit ([tinyurl.com/MMnet04k](http://tinyurl.com/MMnet04k)) has highlighted that people are beginning to see that the company's warning was more than just lip-service.

While our tests showed that not all VPN services were being blocked (sorry, we're not going to tell you who's working), the reaction to the heavier policing of its users has met, as you'd expect, with a fair amount of ire online ([tinyurl.com/MMnet04l](http://tinyurl.com/MMnet04l)). This included the usual threats to abandon the service, in favour of less legal sources ([tinyurl.com/MMnet04m](http://tinyurl.com/MMnet04m)). Exactly what impact the move will have on user numbers remains to be seen, however, but we suspect that Netflix has its eye on the bigger picture of preserving its relationship with big movie makers in the face of increasing competition. And the more it relies on its own content to drive subscriptions, the less geographical boundaries (or people's ability to traverse them virtually) will matter.

**W**hile we're talking about not using internet services in the ways they were intended, we come to the story of how in the future people may find themselves in court over setting up false profiles on social media ([tinyurl.com/MMnet04t](http://tinyurl.com/MMnet04t)). We're not talking about using a nom de plume or nickname here, we're talking about people setting up accounts specifically for the purpose of impersonating, embarrassing or harassing another individual. Pretty indefensible, if we're honest.

**F**ew things in the world of tech raise a smile like a good Steve Ballmer GIF ([tinyurl.com/MMnet04n](http://tinyurl.com/MMnet04n), [tinyurl.com/MMnet04o](http://tinyurl.com/MMnet04o), [tinyurl.com/MMnet04p](http://tinyurl.com/MMnet04p), [tinyurl.com/MMnet04q](http://tinyurl.com/MMnet04q)), and we suspect he knows it ([tinyurl.com/MMnet04r](http://tinyurl.com/MMnet04r)). So this footage of him loving his new post-Microsoft gig serves as a nostalgia dose of sorts: [tinyurl.com/MMnet04s](http://tinyurl.com/MMnet04s).

## .AVWhy?

Videos For Your Eyes...  
Not Necessarily For Your Brain

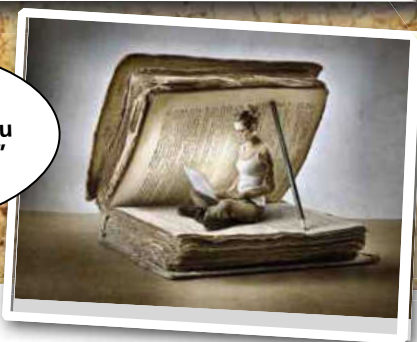
One of the common moans you're likely to hear about modern music is that 'it's all made by machines'. It's a theme that's been endlessly mined by 'real' musicians for years and is still riffed up to this day ([tinyurl.com/MMnet04u](http://tinyurl.com/MMnet04u)). However, when the machines are as impressive as the one built by Martin Molin of the band Wintergaten ([tinyurl.com/MMnet04v](http://tinyurl.com/MMnet04v)), it seems a ludicrous thing to hold against it. In an interview with *Wired* ([tinyurl.com/MMnet04w](http://tinyurl.com/MMnet04w)), he says the machine – which he built himself from wood after conceptualising it in 3D software, and iterating it into its final form – took 14 months to make. Time well spent!





## Caption Competition

"It is amazing what you can find in old books."



This studious young lady was the subject of issue 1402's caption competition, and here are your best suggestions...

- **Thomas Turnbull:** "Transferring 18th century books to eReader had some unexpected problems."
- **doctoryorkie:** "Take the pencil away and that book will become her tome."
- **Thomas Turnbull:** "When I get fully engrossed in a book nothing disturbs me."
- **Thomas Turnbull:** "Well I won't read spells aloud again after this experience."
- **Ondrive:** "Alice had to Google 'where can I buy shrinking potion' after spilling cake crumbs on her book."
- **Frank Everett:** "Joanne felt that history was closing in on her."
- **Mark McE:** "Jennifer took getting engrossed in an old book a bit too literally."
- **doctoryorkie:** "This is what happens when you tell the younger generation that information is hidden in books."
- **wyliecoyoteuk:** "When they start having to employ elves, you know that the cuts to the Micro Mart editing team are beginning to bite."
- **FreakShow!:** "Just need to knock the pencil and facebook will have you forever!"
- **doctoryorkie:** "Pop up library."

Thanks for all your entries, always and congratulations to our winner, **Frank Everett** with "It is amazing what you can find in old books."

If you have something to say about the picture below (come on, you must have), head to the 'Other Stuff' section of our forum ([forum.micromart.co.uk](http://forum.micromart.co.uk)), or email us your funnies via [caption@micromart.co.uk](mailto:caption@micromart.co.uk), remembering to add the issue number to the email.



£57.60 for that

# Raspberry Pi Turns Four

## Happy Birthday, etc...

So, four years on from the last leap year, the Raspberry Pi continues to strengthen its grip on the world.

On February 29th 2012, the original 256MB Raspberry Pi Model B was unleashed, as the company's blog notes "on a largely unsuspecting world". Since that day, eight million units have been shipped, among them three million units of the Raspberry Pi 2. This figures make the Raspberry Pi the UK's all-time best-selling computer, which is just lovely. What was once a handful of volunteers running the ship has now grown into a full-time team of over sixty employees.

And now we have a new model to consider. The

Raspberry Pi 3 is now on sale for \$35 and features a 1.2GHz 64-bit quad-core ARM Cortex-A53 CPU, (that's roughly 10 times the performance of Raspberry Pi 1), integrated 802.11n wireless LAN and Bluetooth 4.1. Completely compatible with Raspberry Pi 1 and 2, this new model promises a 33% increase in clock speed and a 50-60% performance increase in 32-bit mode versus Raspberry Pi 2.

The firm is recommending a 2.5A adapter to power this particular board and with 64-bit support and wi-fi connectivity built-in this time round, now seems as good a time as any to climb aboard the Raspberry Pi train. Show your appreciation by visiting [raspberrypi.org](http://raspberrypi.org).



▲ What a success story...

## Snippets!

### Android Pay On Way

*The Telegraph* has reported that Android Pay, Google's own mobile payment system, is going to be launched in the UK by the end of the month. The system has already been live in America for months and a UK launch is due – especially given that Apple Pay and Barclays' own bPay services have, it would seem, been relatively well-received among consumers. To use Android Pay, you'll need an NFC-enabled Android smartphone, which will store your Visa or Mastercard details.

### Reactions Roll Out

So they're here. No longer do you simply have to merely 'Like' a post you see on Facebook. Now, thanks to the five new 'Emotions' that have been live since the end of February, you can 'Love', 'Wow', or be 'Angry' or 'Sad' or even react with a 'HaHa' should you see fit.

There is still no place for the much-requested 'Dislike' button, however. Facebook, at the end of the day, thought that was too negative to offer.

### MK's Hidden Menu

Thanks to YouTube channel YourMKArcadeSource, hidden menus to the classic *Mortal Kombat* arcade machines have been revealed. The EJB menus, named after the creator Ed J. Boon, are quite the find as they give those privy to them instant access to diagnostic tests, character endings and the ability to enter your initials directly on to the player leaderboard. This last feature is clearly cheating the system, but it's always a thrill to see your name in lights, right?

# WhatsApp Drops BlackBerry Support

### Windows Phone and Nokia devices affected, too

Mobile messaging app WhatsApp has announced that it's going to cease its support for the BlackBerry OS come the end of the year. Along with BlackBerry, older Nokia, Android and Windows Phone devices will also not be supported by WhatsApp (affecting Nokia's Symbian S40 and S60 operating systems, Android 2.1 and 2.2 and Windows Phone 7.1) as the chaps behind the app have, quite sensibly, decided to stop supporting the platforms in which there really isn't an awful lot of interest. The company also noted that those operating systems

don't provide the kind of capabilities required for the app to develop in the future.

This is such a telling comment on the state of BlackBerry in the mobile market. In its blog post, WhatsApp stated that when it was first released seven years ago "About 70% of smartphones sold at the time had operating systems offered by BlackBerry and Nokia."

How times have changed, eh?



# EDF Competition For Girls Won By... A Boy

### Cue a whole lot of criticism

Doubtless before the media furore surrounding this particular news story EDF Energy would have been delighted at promoting its Pretty Curious programme, aimed at attracting teenage girls into the giddy worlds of science, technology, engineering and mathematics – that would be STEM, for acronym anoraks.

Said media furore occurred because a teenage boy, and not a teenage girl, actually won a competition at the heart of the programme. In defence of its decision, EDF Energy said that, while the aim of the initiative

was indeed to inspire teenage girls, the competition was actually always open to all 11-to-16-year-olds to enter.

The winning entry, which was selected by public vote, was a project for a games controller using kinetic energy to power it, while the runners-up included both girls and boys who submitted ideas including smart curtains, smart fridges and sleep monitors.

The problem for EDF Energy is that, while it has defended its position, social media ire against it was plentiful and vocal. In the end, probably not the best PR for the energy firm after all.



# Samsung Starts On 256GB Mobile Memory

## Smarter, faster

**S**amsung has said that it's started working on mass production of 256GB embedded memory using Universal Flash Storage 2.0. The key to this announcement, naturally, is speed. Samsung is claiming that its new modules can read at 850MB/s and write at 260MB/s, which is quite the speed boast – for comparison, it's claiming that the write speeds is three times faster than high-performance, external micro SD cards.

Mobile devices kitted out with USB 3.0 will be able to handle a fair amount of data under this new standard, but USB 3.0 means speedy data transfer – Samsung is stating that a 5GB HD video could be transferred within 12 seconds. So fast.



# Amazon Teams With Morrisons

## Order the weekly shop online

**A**mazon seems to be pretty relentless in its ambition to cater for every one of our shopping needs, and it's now signed a deal with supermarket chain Morrisons to provide both fresh and frozen food to its Prime and Panty customers – with delivery in as little as an hour – and sell those items alongside its current offering of packaged grocery goods.

The deal should be in place within a few months, we're told, but seeing as Morrisons has an existing agreement in place with Ocado to sell its food online via its service it will be interesting to see what kind of an impact the new deal will have. That means it's 'interesting' times both for Ocado and the UK supermarket industry in general, as Amazon looks to move in.

amazon.co.uk®

# “We Want Faster Broadband”, Says IoD

## Business group attacks government's ambition

**T**he Institute of Directors has called out the UK government for its “poverty of ambition” when it comes to broadband speeds, saying that the UK is behind many of our European neighbours in terms of fibre optic installation. The IoD report *Ultrafast Britain* notes that faster broadband access (in the form of 10Gb/s speeds) should be the aim by 2030. For comparison, that speed level is some 1,000 times faster than the government's aim of 10Mb/s by 2020.

The IoD says it wants “genuinely world-beating broadband” and better fibre optic coverage across the country, also claiming the current government target suffers from “a distinct poverty of ambition”.

As for the government's position, a spokesperson said that nine out of ten UK properties has access to superfast speeds. Funny how people are always keen to use statistics and figures to fuel their own narrative...

## Ashampoo Burning Studio 16

The latest version of this uninstaller packs a useful collection of extra tools, as **Roland Waddilove** discovers

### DETAILS

- Price: £39.99
- Manufacturer: Ashampoo
- Website: [www.ashampoo.com](http://www.ashampoo.com)
- Requirements: Windows 7 or later, 2GB RAM, 1GHz CPU, 250MB disk space

**B**urning Studio 16 is the latest CD, DVD and Blu-ray burning software from Ashampoo. Many existing features have been improved in this version, and there are some new features too. Although the price on the website says £39.99, if you download and install the fully working 30-day trial and click the Buy Now link in it, you can get it for the knockdown price of £15.99. Discounts on Ashampoo products are huge if you know how to get them.

This is not a simple burning utility of the sort you can get for free on the internet. No, it does a lot more. There are many extra, but related functions that make it stand out from the freebies. For example, it has some very useful tools for burning music discs from tracks stored on your computer's disk drive. You can shuffle the tracks of an album into a random order, and you can configure equaliser settings on a track-by-track basis, boosting the bass on one track and the treble on another. Tracks can be normalised to the same volume level and you can specify inter-track gaps, including zero, for each track or the whole album.

Music CDs can be ripped to your PC's disk in a variety of



▲ The interface looks good and semi-transparent menus slide out on the left



▲ This is the slideshow creator that turns photos into a playable DVD movie

formats including MP3, FLAC, Opus, APE, WMA and WAV. A cover editor enables CD jewel case covers to be created, and it has some good features. For example, you can enter the name of an album, and it will find the artwork on the internet and download it. It won't find obscure albums, but many popular ones are available. Cover artwork can be found by inserting a music CD too. You can also add extra items like text, tables and

background. It also does DVD boxes, booklets and other artwork. The cover creator has been significantly improved in this version of Burning Studio.

DVD movie discs can be created from movies on the disk drive, and there's a useful slideshow creator to turn your photos into a slideshow that plays on your TV and DVD player. It's like a simple video editor: you add all your photos, and it automatically adds them to a movie timeline

with transition effects between slides. Music can be added to the soundtrack, and you can customise the photos and transitions. It makes the DVD menu, and then you can burn the whole production to disc. It isn't as good as a proper video editor, but it is quick and easy to use, and you don't get bogged down in technical details. It just works, and the finished movie is fine.

Any files can be burnt to a CD or DVD, and disc spanning is available if the content is too large for one disc. The files can be encrypted for security too. Backup and restore modules enable Burning Studio to be used as backup software for your computer. A jump list is available by right-clicking the icon in the taskbar, and it provides shortcuts to common functions.

You might think twice about buying Burning Studio 16 at £39.99, but at £15.99, this is a bargain. The range of features is good, and it has some useful tools for creating movie DVDs, music CDs and box artwork.

**mm Roland Waddilove**

**Packed with useful features**





# Gigabyte P57W

A reasonably priced laptop that combines both performance and looks

## DETAILS

- Price: ~£1280
- Manufacturer: Gigabyte
- Website: [goo.gl/EI7nGE](http://goo.gl/EI7nGE)
- Requirements: Microsoft/Windows account

We've had a few high-performance laptops through our doors recently, each as good as the last and each offering some pretty impressive mobile gaming.

We thought we'd seen everything the industry has to offer – until Gigabyte sent us its latest gaming laptop.

The Gigabyte P57W is monster laptop with a 17.2" IPS display, an equally impressive 2.6GHz Intel i7-6700HQ processor, 16GB of DDR4 memory and a three-storage system that includes a 256GB Liteon M.2 SSD (with Windows 10 64-bit Home pre-installed), a second 1TB Hitachi hard drive and a swappable DVD optical drive – with an included SATA bay caddy to change the optical drive for another hard drive or SSD.

Graphics come courtesy of an Intel HD530 for traditional 2D work, and for gaming there's an Nvidia GTX970M with 3GB of memory to help shift those polygons around the screen.

Connectivity is good, with three USB ports (one 3.0 type-A, one 3.1 type-C and a standard 2.0 port), HDMI, VGA, gigabit Ethernet, mini-DisplayPort, an SD card reader and a pair of audio/headphone ports.

Obviously, there's 802.11ac and Bluetooth 4.1 available as well, along with a 720p HD camera and a pair of 2W



▲ The splendid and sleek lines of the Gigabyte P57W



▲ Inside though is a beast of a gaming machine

speakers. The keyboard is a full-sized anti-ghost 30-key rollover backlit affair, which is well laid out and a pleasure to use, even when you're not gaming. The touchpad, too, covers a large area, is responsive enough for Windows use and some gaming – if you're one of the lucky few who can effectively use a touchpad for gaming.

The design of the P57W is very similar to that of the other Gigabyte P-range laptops. A jet-

black with orange trim colour scheme is used throughout, with a kind of rubberised look to the chassis, which is quite a decent-looking effect.

In terms of performance, the P57W managed to score an overall 9,655 in 3DMark 11, which puts it pretty high on our list of tested systems. In real-world gaming, though, we're talking about *Fallout 4* at maximum settings at 1080p, as well as other titles such as *Star*



*Wars Battlefront*, *Tom Clancy's The Division* and *Elite: Dangerous*. In short, you can happily play the most recent games without too much trouble.

The battery was surprisingly good with the P57W too – something we've found Gigabyte does well when producing its laptops. Looping a full HD video, a full charge battery lasted just over four hours before we needed to plug it back in again. Gaming too managed a decent three hours before the warnings started to appear. Obviously less intensive applications could push the battery life well over five or six hours, depending on what you're doing.

Naturally, you're going to pay a fair bit for this level of performance. However, the Gigabyte P57W is one of the best gaming laptops we've tested for some time. It looks great, performs magnificently and has some great features. So price isn't so bad when you think about it.

If you can afford it, then it's certainly one to consider.

**mm David Hayward**

**Good performance, and it looks superb**



# Devolvo Home Control Starter Pack

Devolvo is riding the Z-Wave to the future of smart devices

## DETAILS

- Price: £179.95
- Manufacturer: Devolo
- Website: [www.devolvo.co.uk](http://www.devolvo.co.uk)
- Requirements: Broadband connection and wi-fi access via router or access point



In the past couple of years Devolo has delivered some very classy Powerline gear, but now it's branching out into IoT territory with its Home Control range.

By way of giving your home control ambitions a kick start, Devolo has bundled three items into an appropriately named Starter Pack. It includes the all-important communications hub or 'Central Unit', and alongside that a door/window contact and a smart metering plug.

My immediate reaction to this is that it covers both the home control and security imperatives, though I'm not sure people generally come to this party expecting to attack the problem so widely from the outset.

For those interested, you can buy the Window sensor and smart plug separately for £39.99 each, making the central unit worth about £100.

To get this kit operational the central unit needs placing at good location in your home, where it's roughly equidistant from all the other devices, but is also near

enough to the router to be connected. Router connection can be via an Ethernet cable or in a power socket that's part of a Devolo dLAN powerline network.

Once this bridge to the internet has been created, you can use it to remotely control any Devolo smart equipment using an app on a phone, tablet or through the web. And it also enables the device to alert you should something change that you need to be aware of.

Those wondering why you need the central control box, rather than just use the router to talk to the peripherals need to realise that this hardware communicates using a wireless technology called Z-Wave, and not any variant of the 802.11 standard.

Z-Wave operates in the sub-gigahertz frequency range, around 900MHz, so it isn't competing with wi-fi or

Bluetooth. However, it does overlap some cordless phone services a little.

This technology isn't designed for high data transfer rates; instead it's focused more on reliability, and it offers a generous range of up to 100m if outdoors, and 30m indoors.

Getting set up is a little fiddly, though you only really need to do it once, thankfully.

Each central control has a unique code that you register on the [www.mydevolo.com](http://www.mydevolo.com) website, and if your router allows the correct ports through, you'll soon be able to add the other items to the system.

Or you can once it has done a firmware update, in my instance.

But actually, you can do so much more than just control

## Contains

- Devolo Home Control Central Unit.
- Devolo Home Control Door/Window Contact.
- Devolo Home Control Smart Metering Plug.







them, because this is an IoT (Internet of Things) solution, and you can build a complex web of interactions through rules, schedules and device interactions.

Therefore you can make the smart meter switch off whatever is plugged into it at 9pm each day, or when the door that the contact sensor is attached opens, or any more elaborate scheme that you can come up with.

Equally, you can ask to be informed when the temperature in any location hits a certain point, or whenever someone comes into the house. The possibilities are, quite literally, endless.

Along with this starter kit, Devolo also supplied a room thermostat, radiator thermostat, key fob switch, wall switch, motion sensor

and smoke detector. These are all easily integrated into the environment, and you can

home as energy efficient or secure as you need, or any combination of those.

**“ You can build something much more sophisticated once you’re ready to ”**

buy additional items of each, depending on your needs.

The only thing really missing here is a control system for a boiler, though I’m sure Devolo is going to add that or enable a connection to Hive or a similar device.

Depending on the direction you want take this solution in, you can have it make your

Comparing this with other IoT collections I’ve seen, this is by far the slickest yet and not especially expensive. Each of the devices is generally well made and designed, and getting them to work as part of a bigger setup isn’t overly complicated or challenging to manage.

What’s great about this hardware is that it starts the

user off in the shallow end of IoT control, yet you can build something much more sophisticated once you’re ready to. This is exactly the right approach, because overwhelming people early on with smart devices is very likely to alienate them.

The only reservation I have is that most people will want the central unit not necessarily with the smart metering plug and the door/window contact sensor. Devolo needs to release it as a stand-alone item, so those wishing to use a particular facet of the solution can focus their initial investment better.

**mm Mark Pickavance**

**A slick IoT home control solution**



# Philips 34-inch Curved UltraWide LCD monitor

David Hayward is a sucker for curves

## DETAILS

- Price: Up to £690
- Manufacturer: Philips
- Website: [goo.gl/wyt0rV](http://goo.gl/wyt0rV)
- Requirements: HDMI 2.0 output for 4K viewing, spare USB port for powered hub

Last year, I had the privilege of testing the BenQ XR3501 before it hit the shelves, and I was extremely impressed with its curved screen, high resolutions and exceptional features.

I haven't had any curved monitors to review since then, so I was pretty pleased to finally get my mitts on this latest offering from Philips.

The Philips Curved UltraWide LCD is one of the Brilliance range of high-performance screens, with a wonderful 34.1 inches of AH-IPS LCD screen, with a 3800mm curvature and an aspect ratio of 21:9.

The resolution offered here is 3440 x 1440 at 60Hz, with a Smart Response time of just 5ms, a standard contrast ratio of 1000:1 and a smart/dynamic contrast ratio of 50,000,000:1. Since it's an IPS panel, you get good viewing angles, with 172 degrees on the horizontal and 178 degrees on the vertical.

Connectivity consists of three HDMI ports, two of which are 1.4 (with one being MHL capable) and the third supporting HDMI 2.0. There's also a DisplayPort, audio in, a headphone socket and a four-port USB 3.0 hub.



▲ The Philips 34" curved monitor looks amazing



▲ The connectivity is excellent

The design of the monitor is excellent, with a white, almost Apple-like rear panel on the screen and an impossibly thin 3mm bezel surrounding the viewable panel. This alone makes the screen size feel bigger than it already is and is a feature we'd wish other monitor manufacturers would employ more regularly.

Curved screens have divided opinion among users. On a big TV, a curved screen can often become an annoyance if you're the family member who sits

toward the outer edges, making sections of the screen appear darker. However, with a monitor, you're sitting considerably closer and usually head on, without other people trying to view your content at an angle. This is where a curved screen works well and, indeed, the Philips model is excellent.

The image quality is superb, with some of the best colour reproduction and depth we've ever seen. The brightness levels are a little high for our personal tastes out of the box,

but it's an issue easily rectified, and when done, the screen doesn't blind you quite as much. A low-blue-light option wouldn't go amiss.

Nevertheless the image quality is perfect, and the gradual curve draws your eyes towards the centre of the screen, with the visible curvature creating a surround effect. There's more than enough screen space to split the screen in two or even three if you want, with a couple of decent 1720 x 1440 monitors in a single unit.

As you would expect, the Philips 34-inch Curved UltraWide monitor comes at a higher than average price – somewhere between £650 and £690. You could argue that three lesser individual monitors are cheaper, but then you wouldn't get the glorious image quality that comes with this curved beauty.

In short, it's an excellent monitor and one that will perform magnificently no matter what you display on it.

**mm David Hayward**

**Expensive, but well worth it**



# BrydgeMini Aluminium Bluetooth Keyboard for iPad Mini

Those wanting to be productive with their iPad get a boost

## DETAILS

- Price: £99.99
- Manufacturer: Brydge
- Website: [www.brydgekeyboards.co.uk](http://www.brydgekeyboards.co.uk)
- Requirements: iPad Mini 1, 2 and 3



Since Apple launched the iPad Pro, more people have been considering using their iPad for more than *Candy Crush*.

Specifically for those with an iPad Mini, Brydge has created a Bluetooth 3.0 keyboard accessory that effectively turn their tablet into a tiny PC, of sorts.

What's nice about this hardware is that it's shaped to exactly mirror the shape of the tablet, so when you push the two together, the iPad actually looks like it was always meant to be a single solution.

The metallic construction helps support this impression, and the keyboard comes in three colours, to match whatever scheme your iPad Mini sports.

To get it operational, you need to power it on and then pair it in the settings. Once done, powering up the keyboard near the iPad will join the two functionality wise.

And given how behind the technology curve Apple's touch keyboard is, it's a very welcome input device for anyone who needs to type more than the odd message.

While the keyboard is small, it's backlit, and the key action has enough feedback to help you type quickly. Brydge states a battery life of three months, and a USB cable is included for you to recharge it.

All good so far, but after using this device for just a few hours I found a few niggles, and the majority are firmly Apple's fault.

The biggest is that unlike Android or Windows 10, iOS just isn't designed to work with a keyboard at all. You can't cursor around the icons or highlight up and down menus, at all.

Unless the iPad is specifically expecting text or number input, it will ignore the keyboard as a means of control and selection. That's annoying, as you have to continually touch the screen to do things that you should be able to more quickly directly on the keyboard.

The fine irony is that if you pair this device to an Android tablet or phone, you discover that all

these things work perfectly, even if the BrydgeMini was specifically designed for Apple hardware.

Another software glitch is that you can become stuck if you either activate a feature (like alerts) that requires a swipe from the bottom edge of the screen upwards. Unfortunately, that's a place you can't reach on the screen when it's attached to the keyboard.

These aspects take some of the shine off what is a nicely engineered and constructed device that by Apple standards is relatively inexpensive.

It comes down to what you think you can achieve on such a small screen with a relatively small keyboard, even if it's as well made as this one. Also,

having access to the iOS versions of Microsoft Office might help too, if you have an Office 365 subscription.

I do hope for Brydge's sake that with the next iOS release the iPad will become more accepting of third-party peripherals than it is at this present time.

**mm Mark Pickavance**

**Elegant Bluetooth keyboard for the iPad Mini**





# Advanced SystemCare Ultimate 9

Roland tries an all-in-one package that cleans, optimises and protects your PC

## DETAILS

- Price: £21.43 for three PCs
- Manufacturer: IObit
- Website: [www.iobit.com](http://www.iobit.com)
- Requirements: Windows XP, or later, 1GB RAM, 1GHz processor, 500MB disk space

Advanced SystemCare is available in three versions: Free, Pro and Ultimate. The first two are clean-up and tune-up tools, with the free version offering just a few basic tools and the Pro version including many more. The difference between these two and the Ultimate edition is real-time virus and spyware protection. In the Ultimate package, on test here, you get all the tune-up and clean-up tools, plus security too.

The software has a smart interface, with classic, dark and readable (light) skins to choose from. Five tabs across the top of the window provide access to the features and functions, and the first is Antivirus. In the past, SystemCare's anti-virus and anti-spyware protection was criticised for being limited, ineffective even, and not up to the standard offered by more popular security software.

The latest Advanced SystemCare Ultimate uses the Bitdefender anti-virus engine, which is one of the best security programs around. It should ensure that you're protected against threats on the internet, but I would still like to see evidence of its effectiveness in virus detection tests. The software can be



▲ These days the security is provided by the Bitdefender anti-virus engine



▲ Clean and optimise, just a few of the many functions offered by this package

installed without enabling the real-time protection if you just want to use the clean-up and tune-up tools. In addition to virus detection, there's DNS protection, which enables you to switch to secure DNS servers instead of your ISP's. There's also Browser Anti-Tracking, which runs certain clean-up actions automatically when the web browser is closed to clear caches, history, URLs and so on.

The Clean & Optimise tab has a large Scan button and a dozen different scan options. You can scan the system for spyware and the registry for errors, as well as addressing

privacy issues like internet caches, file history, junk and temporary files that are no longer needed. There's also a disk defragmenter to optimise the disk contents. Some of these operations can take a long time, so there are options to automatically fix problems and the put your computer into sleep mode afterwards or to shut it down.

The Speed Up tab has several options, and your computer can be optimised for work, games or battery life with a mouse click. This enables or disables various system services according to whether they're needed. A

short list of services you can manually disable to free up memory and boost processor power is provided.

The Toolbox tab provides access to 26 different tools. Some of these are built into Advanced SystemCare Ultimate, but others are part of IObit's collection of free utilities that can be found on the website. The Toolbox makes it easy to access these tools by checking if the one you select is installed, then downloading and installing it if it isn't, then running it. There are too many tools to list, but they include Driver Booster for updating drivers, Uninstaller for cleaning up and uninstalling software, Disk Doctor for checking your disk for errors, a very detailed Internet Booster with comprehensive controls for tweaking browser and internet settings, Smart RAM memory monitor and many more.

There's a lot in Advanced SystemCare Ultimate, especially if you download and install all the tools available. With a three-PC licence costing just £21.43, it's a bargain.

**mm Roland Waddilove**

**A comprehensive collection of tools at a low price**



# Asus ROG Gladius Gaming Mouse

Anthony looks at a mouse that encourages a bit of DIY

## DETAILS

- Price: Around £50
- Manufacturer: Asus
- Website: [goo.gl/rf50Qi](http://goo.gl/rf50Qi)
- Requirements: USB ports, Windows 7 or later for Armoury software

Over the past ten years or so, I've reviewed a fair few gaming mice from a huge range of companies. Generally, they've been impressive, but one or two of them, through long-term use, revealed themselves to have some significant weaknesses, which it would have been impossible to see at the time of review. Chief among these problems were broken cables and unresponsive buttons.

Asus, it seems, is well of aware of these issues, though, because with the Republic of Gaming Gladius, you get not only two spare switches for your two main mouse buttons, you'll also find in the box two cables of different lengths (one 2m braided and one 1m regular rubber coated). You also get four spare stick-on feet, in case the ones already on the mouse peel off, two ROG stickers and a handy little pouch to put the Gladius in.

The mouse itself is a right-handed affair, with a mostly standard shape, although Asus claims it's particularly ideal for FPS players. That might be the case, but it should be okay for any game genre.

As well as the main two mouse buttons, the Gladius also offers back and forward navigation buttons on one side and, on top, a single button used for alternating between two customisable sensitivity settings.

This is all fairly run-of-the-mill for a gaming mouse and, if

anything, some players might expect more from a £50 device. But that would miss the point of what Asus has done here. Yes, it's true that other gaming mice have more buttons and a greater range of on-board DPI settings. And the absence of an adjustable weight system and a profile switch might put some buyers off (although others consider such things little more than gimmicks).

Whether these are things you use or not, there's no doubt that a lot of the luxuries you'd normally associate with a premium mouse are missing from the Gladius, but the focus is clearly on long-term use. The mouse cable, for a start, is detachable. Sliding the switch on the underside of the mouse's body, you can pull out the cable. Looking at the end, you'll find it

uses a standard micro-USB connection, so you won't struggle to find a replacement if you somehow manage to break both the included leads.

The replaceable switches, meanwhile, are easy to fit. They do require you to remove the feet underneath and to take out the screws beneath them, but changing the switches over is simply a case of pulling out the old ones and slotting in the new ones.

The software, meanwhile, is straightforward. Going by the name of Armoury, it allows you to define functions for each button, as well as assigning macros to them. This is also where you choose your sensitivity settings (up to 6400dpi), perform a surface calibration routine, alter acceleration and deceleration,

tweak the polling rate (up to 2000Hz) and mess around with the potentially useful 'angle snapping' feature.

And for those who care about such things, you can toggle the red LEDs under the logo, the scroll wheel and the DPI switch. What you don't get is different coloured lights, which can be useful for quickly seeing which profile you're on. This makes sense, though, seeing as there's no profile switch on the mouse itself, but that in itself just highlights another problem: to change profile you need to go into the Armoury software. It may not be a massive chore, but it's yet another thing missing from the Gladius that can be found elsewhere.

But in the end, none of these things are really necessary. The Gladius has all the essentials of a good gaming mouse, and it gets them all right. And what matters most is its potential longevity. Sure, you could get something more fancy for around the same amount of money – or even less – but the modular nature of the Gladius means it's more likely than the competition to still be functioning in a few years' time. For that reason alone, it's worth serious consideration.

**mm Anthony Enticknap**

**Not fancy but built to last**



# GROUP TEST

## Portable Projectors

Projectors have come a long way in recent years. Gone are the huge devices that sounded like lawnmowers when powered up and which needed their own trolley to move around.

Instead, these days we have small, portable projectors. Most can be chucked into a handy bag, while others can fit in your pocket.

We have six to test, to see which will work best for you.

### Portable Projectors

## Philips PPX2480 PicoPix Pocket Projector

#### DETAILS

- Price: £279
- Manufacturer: Philips
- Website: [goo.gl/XRXFtc](http://goo.gl/XRXFtc)
- Requirements: Mini-HDMI to full-sized HDMI cable for tablets, USB devices, SD card



▲ The Philips PicoPix is a great little pocket projector



▲ Image quality is good, despite the size of the projector

Measuring just 105 x 31 x 105 mm, this wee projector has a host of features that you wouldn't normally expect to see on something of this size. An internal battery that can last for up to two hours on ECO mode, an 80 lumen (when running on AC power), LED light source, connectivity for SD/MMC cards and USB, 2GB internal memory, a HDMI port and a built-in 1W soundbar all speak of a much bigger unit. But somehow Philips has managed to cram all this into a small package.

Hooking up the projector to a laptop is an easy three-step process: simply connect the included HDMI cable to the projector and laptop, provide power to both and sort out your screen from within the laptop's operating system. Of course, with the projector having an internal battery, you could easily cut this down to just two steps, or you could just insert an SD card containing images, movies or music, power up the projector and point it at a convenient wall.

There is, of course, the problem with heat and consequently fan noise, as with most projectors. The PicoPix isn't immune to this, and after a minute of use it will start to heat up and power up the noisy internal fan, which can otherwise ruin the viewing pleasure of a home entertainment setup.

Ideally, you wouldn't be using

this projector in a eight-by-eight living room, and in reality you would require a reasonably dark environment to get the full benefit of the 120" projected screen. But while the PicoPix may not be a contender for the full-time post of large projected screen entertainment, it does an admirable job for polished presentations and brief moments of picture and movie enjoyment.

The build quality of the projector is very good, with a sturdy piano-black casing, easily accessible ports along the rear, a tripod attachment on the base and power slide-button on the side. There are menu controls on the top of the unit, to navigate the internal operating system and a focus thumb wheel. The menu navigation buttons have a rubberised cover over them but feel a little too flimsy, compared to the rest of the unit. However, the included remote control is solid enough and can operate the projector from an angle of 60 degrees and within 3m.

You're provided with enough cables to establish a connection to a VGA and composite output, along with two USB cables, a female to mini-male USB and a standard mini-USB.

The projector worked well enough, though. The menu system was easy to navigate, and the built-in media player ran through a selection of different video formats without any problems, with the brightness dropping to 55 lumens when used via the battery, which was still enough to enjoy a movie. Connection to a laptop was straightforward, and we didn't experience any terrible trapezoidal keystoneing, as with other projectors in the past.

On the whole, a good enough pocket-sized projector. Ideal for presentations on the go and sharing moments of family entertainment.





## Pico Genie P100

### DETAILS

- Price: £217
- Manufacturer: Pico Genie
- Website: [goo.gl/W9Nkk](http://goo.gl/W9Nkk)
- Requirements: HDMI port on the laptop/conversion to a tablet

**P**ico Genie is a British brand specialising in small LED portable projectors. Its range of Pico Genie projectors are reasonably priced and offer some of the best technical specifications we've seen, even from the entry-level models.

The Pico Genie P100 is one of the company's smallest and lightest models, measuring just 99.5 x 99 x 22.5mm and weighing a mere 230g. However, despite its diminutive proportions, it does manage to project a maximum viewing area of 60 inches, with a native resolution of 854 x 480 and a brightness level of 80 lumens when both on the battery and plugged into the mains.

The P100's connectivity consists of a full-sized HDMI port, a USB charging port and an audio jack. The USB port is simply to allow you to charge your phone or tablet while it's connected to the projector. There's a control section on the top of the projector for setting up the image and controlling the volume of audio, pushed out through a pair of 1W internal speakers.

The size of the P100 and its simple connectivity means it's a projector that's ideally suited for those who need to display a quick presentation, rather than a home theatre system or a lecture theatre. That's not to say you can't, of



▲ The Pico Genie P100 is a stylish and capable mini-projector



▲ It's simple, easy to use and quite effective

course. The P100 does manage a 60" projected display well, with a decent amount of brightness and colours while still remaining quite sharp and detailed. We imagine teachers would benefit from the P100's size and quick launch and

rest of the unit. Still, it worked well enough.

The 80 lumens isn't going to produce the best image during daylight and in well-lit rooms, naturally. But it's enough for the scenario we mentioned. And the Pico Genie P100 only costs £217,

that the lumens remain the same when you unplug the power, with no drop in brightness when switching the plug on or off.

The Pico Genie P100 is a stylish, perfectly capable and reasonably priced micro projector. What it may lack in extra features, it makes up for in its compact design and quick setup and use times, which is often more of a much-needed feature than built-in wi-fi or an SD card slot.

“ A stylish, perfectly capable and reasonably priced micro projector ”

connection, where they'll hook it up to their tablet to display something to the students.

The build quality is really very good. It feels solid, well constructed and capable of taking a few knocks while it's being transported.

One element we did feel a little cheap, though, was the side-mounted focus thumb-dial; it felt a little too light and not quite as well balanced in terms of construction compared to the

which puts it well within the budget of someone who wants to project their information for a brief time to a reasonable sized room or office.

The lamp life is rated at 20,000 hours, and the internal rechargeable battery lasted just over an hour and a half in our tests. If you're using the USB charge for a phone or tablet, then we suspect it'll drain pretty quickly – in less than an hour. We did, however, like the fact



## Portable Projectors

### Acer C120

#### DETAILS

- Price: £185
- Manufacturer: Acer
- Website: [goo.gl/K1Lj9Q](http://goo.gl/K1Lj9Q)
- Requirements: Two spare USB ports on the laptop/PC

The Acer C120 is another ultra-portable projector that's ideally aimed at the business user on the go. The fact that you're quite able to whip one of these out alongside your laptop and get it up and running in a matter of minutes is a great selling point, but there are some significant setbacks along the way.

It's quite small, measuring just 120 x 82 x 26mm and weighing only 300g. The projected image has an 854 x 480 resolution at around six feet from a wall, with a 50" image. Although it's advertised as being able to produce a resolution of 1280 x 800, we never managed to get it up that far for some reason.

At 100 lumens, it's not too bad for a portable projector. The noise levels aren't too bad either, even when the fan speed is increased.

The minimalists among you will certainly appreciate this projector. The left side of the unit has a small focusing wheel, while the right-hand side has the ports for USB and power. The lack of an on/off button, menu button or anything else is actually quite off-putting to some degree, as you always feel like you're about to break the unit when plugging it all in and having it lurch into use. Likewise, you just unplug the unit when you're done, which again goes against everything you've ever learned regarding proper projector power-down procedures.

In terms of the design, it's generally okay, but nothing too astounding. The top is a glossy black and quite flimsy plastic that's a magnet for fluff, fingerprints and cat hairs. The sides have a series of ridges running down, which break up the heat output vents, and the bottom of the unit is a matte-black affair with a set of sturdy rubberised feet to stop it from sliding off the table, and there's an absolutely useless, tiny kickstand. Functional yes, but hardly a design innovation.

Connecting the projector is a little different from the norm. There aren't any video ports to

plug anything into, just a simple USB 3.0 arrangement. The C120 comes with a USB Y-shaped cable which is required to plug into two USB ports on your PC or laptop. From this, both the video and power are fed via your computer, which is a bit of a pain as you've already lost a couple of USB ports in just the setting up. Owners of Chromebooks or ultra-slim laptops, be advised.

You do get an external power supply as standard, though, but the way in which the cable arrangement is dealt with means you need to have



▲ The Acer C120 uses a couple of USB ports on the laptop or PC, so make sure you have enough free

◀ It's a reasonably good projector, despite the USB problem

everything really close together (power, computer and projector), which isn't always an ideal option.

The Acer C120 will no doubt suit someone who needs the unit close to their laptop or PC. While portable, it's not always very functional, due to the cable length limits and the use of a pair of USB ports on the computer side.

But the image is good enough for most users, classrooms and so on.



## InFocus IN122

### DETAILS

- Price: £365
- Manufacturer: InFocus
- Website: [goo.gl/m9pdRs](http://goo.gl/m9pdRs)
- Requirements: Spare HDMI, VGA or other video ports



**T**he InFocus IN122 is this group's borderline portable projector. While bigger than what we've looked at so far, it's still smaller than the average projector and is often used by those who present information on the go.

The entry-level IN122 may well seem like the bottom of the InFocus range, but it has some surprisingly good features. For starters, it measures 235 x 284 x 70mm and weighs 2.2kg, which isn't too bad for a carry-around projector. The 3200 lumens is great for a large meeting room or classroom, and manages to achieve a good and sharp quality image in a room with a fair amount of ambient light. The DLP technology of the IN122 has a native resolution of 800 x 600, with throw distances of between 5ft to 39ft, offering a projected image size from 40 inches up to an impressive 303 inches.

The 230W bulb has a normal lifespan of 3,500 hours, with an eco mode lifespan measuring 5,000 hours, and the fan noise is cut down to a manageable 30 decibels in normal mode, with a slight drop to 28 decibels when in the eco mode.

Connectivity is good too, with a single HDMI port, two VGA, composite video, S-video, RS232 service port and a VGA out. There's also

▲ *You get a huge number of connections, but it does run quite hot*

mini-USB, audio in and out to improve the specs, but the built-in speakers only manage to squeak out a meagre 2W mono. The included remote is generally okay, although the buttons are a little squishy and need to be firmly pressed before they're recognised.

good job of keeping the screen clear and free from any noticeable lag. However, you don't get any 3D glasses in the box, most likely because it's not initially aimed at the home theatre crowd, but we think a pair or two of glasses wouldn't go amiss.

against it. But it's not as big as most standard projectors, and there's a far better level of connectivity and image quality. It does cost considerably more, though, at £365.

**“ When displaying 3D content it does a very good job ”**

The IN122 actually looks a rather sleek unit. The top front half of the projector has a matte-black design and houses the lens focus adjustment slider. The back half has a glossy black finish and contains the touch-sensitive menu controls. The rest of the projector is of a ridged design that covers the vents, and it's worth noting that despite the general low cost of the product, none of the parts involved feel cheap in any way.

This is also a 3D enabled product, and when displaying 3D content it does a very

Despite the good points, though, the InFocus IN122 does tend to vent out a fair amount of heat, far more than the others we tested so far. If you're unfortunate enough to be sitting near it when viewing something, then you'll feel like there's a hairdryer at work on the back of your neck. In fact, the heat built up so much at one point that we couldn't pick the projector up for a few minutes until it had cooled down.

It's bigger than the ultra-portable models in the rest of the group, which works





## Portable Projectors

### Vivitek Qumi Q5

#### DETAILS

- Price: £450
- Manufacturer: Vivitek
- Website: [goo.gl/jBxH8C](http://goo.gl/jBxH8C)
- Required Spec: Spare HDMI port

The Vivitek Qumi range of pocket-sized LED projectors offer sleek design and are made to be the projection companion of the smartphone or tablet. Starting with the entry-level Q4 model, the range now extends up to the Q7 Plus, with the Q5 being the mid-range choice for portable projectionists.

The Qumi Q5 is certainly a stylish-looking design, with a choice of colours matched to your phone case, but it's not just the device that look good. With Pico LED DLP technology, a native resolution of 1280 x 800 and a 500 lumen brightness level, all shoehorned into a projector that measures 160 x 102 x 32mm and weighs 490g, it's not a bad choice for who need a decent image projected while on the go.

Connectivity isn't too bad either, with Vivitek managing to squeeze in a HDMI with MHL port, a USB port, audio-in and an AV-in 3.5mm jack, an IR sensor pad for the included mini-remote and a 24-pin universal IO port too. There's also a built-in MS Office Viewer app included with the Q5, which can launch PowerPoint, Word, Excel and even PDFs without it needing to be connected to a laptop or phone.

The projected image quality of the Qumi Q5 was really very good. Detail was good, the image was clear, and the colours were equally bright and well produced. The 500 lumens also

helped the projector display its maximum 90" image even in a fairly well-lit room with a better than average level of clarity – certainly one of the best we've seen so far.

The design and build quality of the Q5 is good too. It feels sturdy enough for carrying around, and the focus wheel on the left of the unit is as well constructed and solid as the rest of the unit. The mini-remote that comes with the Q5 isn't great and was the worst aspect

of the entire setup, with it feeling much cheaper than the other packaged items and the projector itself.

You get a collection of cables, HDMI, USB and so on, as well as the small power brick, the aforementioned mini-remote and a squishy cloth bag to safely carry the Q5 around in. Overall, it's a neat setup, with everything you'll need to get up and running as quickly and as easily as possible.

We really liked the Vivitek Qumi Q5. It's a sleek, pocket-

sized and very capable projector that will work well with presentations and even a home cinema setup – although you'll need to output the sound through something better than the built-in 2W mono speaker.

The only downside is the price. You may be able to pick one up a little cheaper, but considering the bulb life of 30,000 hours, better than average picture quality and brightness, it's not a bad buy.



▲ The capable and stylish Vivitek Qumi Q5 may be expensive, but it's very good



▲ It's available in a range of colours, to match your phone case, no doubt

## Casio Slim XJ-A252

### DETAILS

- Price: £1090
- Manufacturer: Casio
- Website: [goo.gl/COJ5TQ](http://goo.gl/COJ5TQ)
- Requirements: Spare HDMI, VGA ports

If we're being honest, we never really imagined featuring a Casio device in one of our group tests, unless it was about calculators or watches. You might be surprised that Casio makes projectors, but it does and, as it happens, it does it quite well.

The Casio Slim range of projectors are some of the most technically advanced models in this entire group. With a patent pending hybrid light source that combines LED and laser technologies, this 296 x 209 x 42mm projector manages a native resolution of 1200 x 800, 3,000 lumens and a maximum projected screen size of 300 inches.

The hybrid light source has an estimated lifespan of 20,000 hours with a mercury-free lens/components. It's this green technology that makes the Casio Slim a good solution for companies that are trying to lessen the environmental impact. It's a fairly low power projector too, with a 120w eco mode, dropping to 0.14w when in standby.

Connectivity on the Casio Slim consists of a HDMI port, VGA, a stereo mini-plug and a USB port, which can be used to project the company or school logo as the unit powers up. There's an array of touch-sensitive controls along the top of the unit, to configure and tweak the



▲ The Casio Slim XJ-A252 is an interesting projector using a new light source technology



▲ It is very expensive, sadly and not as good as we hoped

image. Interestingly, the Casio Slim also has a 2GB flash memory module installed, so you can drop your presentations, movies and so on into it and project the contents without the need to actually connect the projector to a computer or tablet/phone. From there you can use the bundled remote to control the content, much like the Philips PicoPix model.

The image quality, though, despite the technology involved and high brightness, wasn't as good as we were expecting. It was good either, but we felt it wasn't quite as sharp or as detailed as the likes of the Vivitek Q5, and the colours weren't as rich as the Pico Genie we tested.

We did think that perhaps we were using the projector

in its eco mode, but when activated, that dimmed and lessened the quality of the display even more. It's a shame really, as we were quite behind the new technology.

On the plus side, the build quality was very good. And the projector was quick to power up and use, and easy to get an image out of from a laptop. Business users in a rush can get up and running in less than 30 seconds, for example.

Although the images wasn't as good as we hoped, the Casio Slim XJ-A252 is a decent little portable projector. There's enough connectivity, it's quick to use, and the 2GB internal memory is a nice feature. However, the price may well turn off

many users – even business ones. At around £1090 it's the most expensive entry in the group, and sadly the one that many users will probably shy away from.





### Philips PPX2480 PicoPix Pocket Projector

The Philips PicoPix Pocket Projector has the right combination of technology, price and connectivity. It's a great little unit, and although we've seen better image quality, the other factors make it stand out.



### Pico Genie P100

This week's Highly Commended was between the Pico Genie P100 and the Vivitek Qumi Q5.

Both are great little portable projectors, but we think the Pico Genie has it on price, although the Vivitek does offer better projector technology. It's something you really need to try yourself in the environment you're going to use it in before committing to a buy.

## How We Tested

Each projector was connected to a laptop and an Asus tablet via HDMI and mini-HDMI where possible. We used a selection of office documents, images, videos and some basic gaming (using the game *SuperHot*) to see how well the projectors functioned with static and fast moving images, as well as colour and detail in a well-lit room.

	Philips PicoPix PPX2480	Pico Genie P100	Acer C120	InFocus IN122	Vivitek Qumi Q5	Casio Slim XJ-A252
Price	£279	£217	£185	£365	£450	£1090
Dimensions	105 x 31 x 105 mm	99.5 x 99 x 22.5mm	120 x 82 x 26mm	235 x 284 x 70mm	160 x 102 x 32mm	296 x 209 x 42mm
Weight	290g	230g	300g	2.2kg	490g	2.3kg
Lumens	80	80	100	3200	500	3000
Max Projected Image Size	120"	60"	50"	303"	90"	300"
Connectivity	Mini-HDMI, USB, SD cards	HDMI, USB	USB only	HDMI, 2xVGA, Composite, S-Video, USB	HDMI, USB	HDMI, VGA, USB



# Top 5

# Videogame Villains

We pick some of our favourite gaming bad guys...

## 1 Bowser

For several decades, everyone's favourite double-named Italian plumber, Mario Mario, has been antagonised by Bowser. This giant turtle-like creature has a penchant for capturing princesses and generally being a pain in the backside, and it's up to Mario and his brother, Luigi, to thwart his plans. But in spite of being repeatedly defeated, Bowser manages to come back again and again. In fact, considering how much time the Mario brothers spend fighting him, you have to wonder how much plumbing they actually manage to get done.

## 2 Wario

Constantly using Bowser as Mario's nemesis could be considered a little unimaginative. Clearly, though, Nintendo wouldn't stand for such criticism, which is no doubt why it came up with a new villain: Wario. Okay, maybe not the most original name, but what about his appearance? Er... nope, nothing original there either: he looks almost exactly the same. Surely that's because he's an evil twin, right? Apparently not. According to Nintendo itself, Wario is in fact Mario's childhood friend ([goo.gl/hSvFu9](http://goo.gl/hSvFu9)). Whatever the case, at least he's more imaginative than... ahem... Waluigi.

## 3 Dr Robotnik

Also going by the name Dr Eggman, Robotnik is clearly an intelligent, talented man, judging by the amazing machines and vehicles he creates in the *Sonic* games. And what does he use his abilities for? Capturing fluffy bunnies and little birdies. And who is his arch enemy? A bright blue, 5ft tall, bipedal hedgehog – not really something you can plan for. No wonder he always loses.

## 4 Shang Tsung

Reach the end of *Mortal Kombat*, and you're faced with the ultimate threat: an elderly Chinese man sporting a long beard and a dress. Sounds easy enough, until you recall that he could transform into every

other character in the game, gaining all their special moves and so on.

In later games, he was a much younger man, but the morphing ability remained. Without doubt, one of the most original bosses in a videogame.

## 5 Goro

Before you ever got to fight Shang Tsung, however, you had to get past an enormous four-armed half-man/half-dragon called Goro. As well as being a musclebound killing machine, Goro also enjoys walking around in nothing but his pants. To be fair to him, though, it's probably hard to find shirts that fit him properly. But that doesn't excuse him for having hair like a netball player. Not that we'd ever tell him that, of course.



▲ Goro was eager to show off his Dale Winton tan...

# The FBI Vs Apple Inside Story

**Mark Pickavance reveals some of the very telling subtext to a story that mainstream media and politicians can't grasp**

**A**fter the war on terrorism, the new target seems to be the war on privacy – or more specifically the war on encryption.

A recent focal point for these events is a spat between the FBI and Apple, because the agency would like Apple to hack its own encryption, which it designed to be unbreakable. Understandably, Apple doesn't want to use its resources to do that, to prove that it lied to its customers when it told them their information was 100% secure.

If you've watched the news on this subject, you'll already have a handle on how important these events are, even if very few people commenting appear to have any handle on what this argument is really about.

When those bidding to become president of the USA were quizzed on the issue, it soon became very apparent that not one of them actually understood it or had anything useful to contribute at all.

There is, however, plenty about this story that hasn't been well publicised, which might well put a fresh perception on it if people realised what really went on.

If you haven't followed this story, then I should explain that the FBI is investigating a terrorist incident in which Rizwan Farook and his wife killed 14 co-workers in San Bernardino, California, before themselves being gunned down by local law enforcement.

Afterwards, Farook's iPhone became a critical piece of evidence, as those investigating the case wished to find out who might have known about the couple's intentions or perhaps aided in its inception and execution.

The phone technically wasn't owned by Farook; it was a device provided to him by the San Bernardino Health Department, so Apple considered it to be the device's 'owner'.

But Farook did secure the iPhone with a four-digit numeric password, a protection that has entirely stumped the collective resources of the FBI. Therefore, it has asked Apple to circumvent the protection, so it can access the contents of the phone. Apple has refused, despite the FBI getting a court order.

That pretty much sums up the story as presented in mainstream press, but those facts are actually the least interesting aspects of this tale.

## Countdown To Fiasco

For those who don't own an iPhone, I should point out that Apple's encryption on it is pretty sophisticated stuff, and by default all phones come pre-encrypted.

Four digits also might not sound like much to hack, with just 10,000





**“ Telling everyone that there’s a special FBI backdoor is effectively the same as saying that their phones have no security ”**

possibilities, but you only get ten chances to guess right before what’s on that phone is lost forever.

But surely that’s not a problem, because the phone backs itself up to Apple’s own cloud services, and Apple does have access to that, so you can buy a new phone and then have all your data magically appear on your new device!

Given this basic information, which even I understand, and I’ve never owned an iPhone, surely all the data on that phone should be sitting in the inbox of the lead FBI agent on this case by now? It isn’t, so why is that?

When the FBI first got hold of the phone, it contacted Apple and explained its dilemma. Apple told it that the phone would back itself up as soon as it was brought near a wi-fi access point that it had previously used. Apple suggested to the FBI that it take the phone to Farook’s house and use the wi-fi there.

Unfortunately, the FBI had already swooped on that location and taken all the equipment away, undermining the investigation.

Apple suggested instead that they take it to his place of work and get it to sync there. But magically by the time it got there, it was stuffed. How did that happen?

Someone at the San Bernardino Health Department took it upon themselves, as the ‘owner’ to send a reset request to the phone’s iCloud password.

Once this was done, the phone wouldn’t sync, as it didn’t have a verified password until a new one was created, and to do that you’d need the pass number to unlock the phone to enter that new password creation cycle.

Why would someone do something so stupid? Well, according to a tweet that the San Bernardino County sent out, “The county was working cooperatively with the FBI when it reset the iCloud password at the FBI’s request.”

Eh? So the FBI told these people to do something that stymied the case, and now it’s all Apple’s fault, because it won’t spend millions and use its best people to undo what was done?

That’s like the FBI taking a pile of ashes that was once a book to a forensic scientist and demanding to know what was on it, having previously set it on fire.



## Final Thoughts

When events like these unfold, we’re given a rather stark choice between the cock-up theory or the failure-by-design option. Neither in this case paints the FBI in a very good light, because its either quite inept or conspiring to get encryption removed from phones by nefarious means.

Assuming that it’s inept, which is probably the nicer option of the two, I’m very curious about why it didn’t just ring its buddies at the NSA or CIA and ask them what they do when they want data off an iPhone?

Surely they have a method that works for them, or do terrorists only need encrypted phones to be untouchable? I think not.

Perhaps they were too embarrassed to call. Whatever the reason, security services in the USA in general have been trying to get encryption outlawed in the USA (and the rest of the world) for some time.

The general view is that it would be easier for them if it didn’t exist and, oddly, organised crime is fully with them on this point.

There is also some evidence that this wasn’t entirely a cock-up. In the court paper that the FBI issued when it went after a Motion to Compel, it revealed that although it told everyone that the house Farook lived in had been fully processed, it now turns out it wasn’t.

The suspicion that is most obvious is that the FBI knows enough about Farook and his partner to know that there is very little on his iPhone that they don’t already know, and that the entire purpose of making this mess was to corner Apple into doing something it’s repeatedly resisted.

Apple isn’t likely to give up its security bone, because telling everyone that there is a special FBI backdoor is effectively the same as saying that their phones have no security.

Given the number of legal levels we have to go through before we get to the Supreme Court, this could take some time – unless a crazy person becomes US president and uses executive powers to compel Apple to do the government’s bidding.

Should that happen, the market for Apple products could take a sudden dip, especially outside the USA. [mm](#)







# Chromecast

## Tips, Tricks and Apps

**David Briddock explains how to get more from your Chromecast**

In July 2013 Google released a small, thumb-drive sized HDMI device that quickly leapt to the top of the sales charts. Called the Chromecast, this £30 device brought the world of online streaming media to any television with an HDMI socket, and it promised desktop, laptop, tablet and smartphone owners an affordable wireless big-screen experience.

### Inside

For £30, or \$35 in the US, you might not expect all that much from a Chromecast dongle, and it's true that many buyers settle on for using a relatively small list of Android and Apple iOS mobile apps like YouTube, Netflix and iPlayer – while desktop and laptop PC owners cast the contents of a their Chrome browser tabs, but not much else.

However, underneath that diminutive case there's a surprising amount of power. Inside a Chromecast dongle there's a mini system-on-a-chip processor, with 512MB of RAM and 2GB of flash storage, and a hardware-based decoder delivers smooth video experience at 1080p HDMI. Taken together this little package is enough to run a simplified version of Chrome OS, similar to what you'd find on a Chromebook laptop or Chromebox desktop.

And it's the inclusion of this highly capable and well understood operating system that delivers so much potential. Most importantly it has a built-in wi-fi module, complete with tiny antennas, which communicate bidirectionally with the home's wi-fi router and nearby PCs, smartphones and tablets. These computing devices can then act as a smart remote television controller using the CEC standard (see boxout).

With all this capability wrapped up in the diminutive Chromecast case there's lots of potential to improve and extend the user experience. Here are a few tips, tricks and app suggestions to unlock the true potential of your Chromecast.

### Second-Generation Chromecast

In 2015, around two years after the initial release, Google announced the second incarnation of its Chromecast dongle. This new version has superior video streaming performance thanks to an upgraded internal dual-band wi-fi router and improvements in the wireless antenna array.

Chromecast 2 is easily identified by its round case and short flat HDMI cable. It also comes in three colours; yellow, black,

and red. The short cable avoids the issues some owners had with inconvenient HDMI socket locations. This round design also mirrors its sister Cast dongle, which enables your audio system to receive and play streamed audio content.

### Smoother Wireless Video Casting

The Chromecast dongle works best when it's streaming content directly from the Internet and your smartphone or tablet is acting as a remote control. When you're using the 'Cast' Chrome extension to mirror browser tabs things aren't quite so reliable. Why is this? Well, with natively supported sites like YouTube, Netflix and iPlayer the file is played directly through Chromecast. However, play a video from a cast Chrome browser tab and the host computer has to act as a web server, streaming the content to the Chromecast device. Thus, when tab casting, the audio can fall out of sync with the video, depending on the strength of the wireless network and the host computer's power.

“ It can do a whole lot more than just stream video from YouTube and Netflix ”

If this happens to you, try downgrading the video quality of the stream. Open the Options menu and set the 'projection quality' item to Standard (480p). While the video won't look quite as sharp, at least it'll be watchable.

### Direct Connect Option

If you encounter the sort of casting problems mentioned above, but don't want to sacrifice video quality, there's another option. Google also sell an ethernet adapter Chromecast accessory, available for £15 from the Google Play store website ([goo.gl/CPTxAS](http://goo.gl/CPTxAS)).

This ethernet adapter looks very similar to the Chromecast power cord, but in this case the plug end includes a small Ethernet port. This means you can connect it directly to your router using a standard ethernet cable and bypass any wi-fi performance issues.

### Maintain Full-screen Video Mode

When you send a video from your phone or tablet to Chromecast, you're free to close the app and do other things at the same time. But when using the Chrome browser on your PC to watch a video you'll need keep the tab running in full screen mode at all times, or else it won't appear in full screen on the television.

A workaround for Windows users is to use the Alt+Tab shortcut to switch to another app. This allows the video to play in full screen mode while you do something else. To return to the video click on the Chrome window tab in the taskbar. Mac or Linux users can do something similar using their multiple desktop switching functionality.



### Stream Local Files

Chromecast doesn't always have to stream its content straight from the Internet. Instead cast a Chrome browser tab on a Windows/Mac/Linux PC or Chromebook then browse and open local files to stream them to the big screen.

#### ▲ Beta extension settings

On a Windows PC open a new tab then enter 'file:///C:/' in the address bar. For a Mac it's a similar process except this time enter 'file:///localhost/User/my-user-name' in the address bar (replacing my-user-name with your login name).

Cast this newly opened tab then open any Chrome-supported file type (.mp3, mp4, and so on) to see it on the big screen.

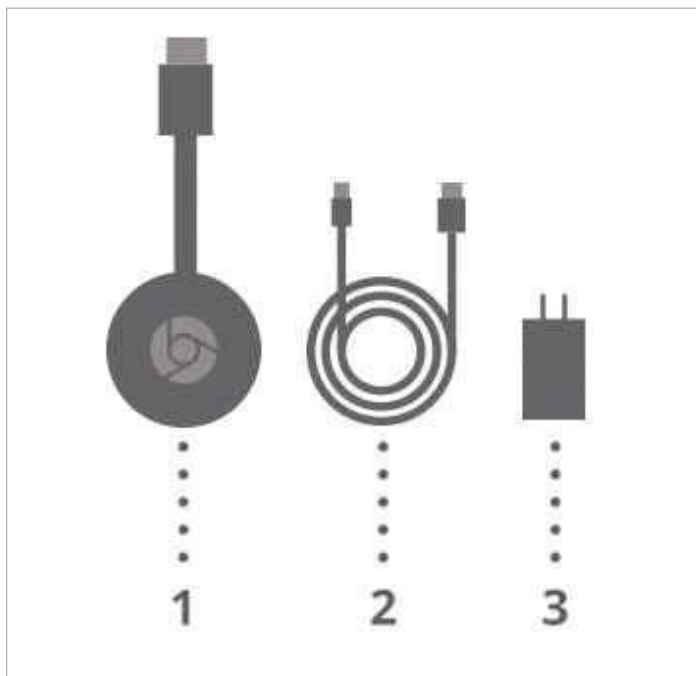
### Try The Beta Extension

Google's standard Chromecast extension is somewhat limited in functionality. And the options aren't exactly overwhelming either, limited to just video resolution settings.

However, true to Google tradition, there's a Beta version of the official extension. This includes a number of extra goodies to explore, accessed via an extended 'Options' menu. But remember, as it's in Beta what's on offer is classed as experimental, so some features may be a little rough around the edges.

One option is the 'Cast to Hangouts' switch, which presents your Chrome tab or window to a Google Hangout. Of course, you will need to be signed in to Google to take advantage of this capability. Google has provided a handy webpage to help with Hangout Casting setup and information, including Google Calendar scheduling ([goo.gl/TJT7jS](http://goo.gl/TJT7jS)).

You can also mirror the complete desktop through Chromecast, rather than just a single browser tab. This opens up a huge new set of functionality. For example you could play media via desktop apps like iTunes, Spotify and VLC. Or share full-screen photo slideshows and display PowerPoint presentations. To optimise the user experience there are settings for things like display resolution, frame rate and latency.



▲ Chromecast setup steps

## “ Inside a Chromecast dongle there’s a mini system-on-a-chip processor, with 512MB of RAM and 2GB of flash storage ”

There’s also a toggle to enable Cloud Settings, though you’ll need to be signed into Chrome to take advantage of these features. The developer community hasn’t been forgotten, either, they can pop up a cast activity log window and set additional receiver IP addresses.

### Try Other Chrome Extensions

Chrome browser extensions are built using standard HTML5, CSS and JavaScript technology and tools. This has encouraged many thousands to develop their own Chrome customisations. There’s loads of extensions to try. Popular topics are image slideshows, music streaming, TV shows, radio players, note takers, todo lists, diary managers, and social communication. Many significantly enhance the Chromecast experience.

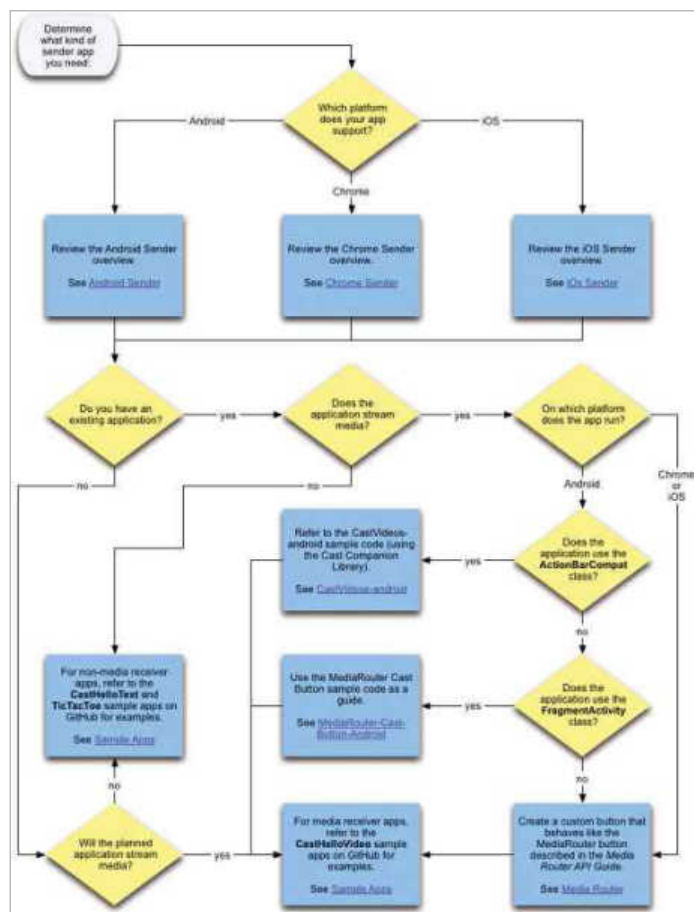
To see the full list of Chromecast-related browser extensions visit [goo.gl/ozH2KP](http://goo.gl/ozH2KP).

### Try Other Apps

Android and iOS smartphone owners get polished YouTube, iPlayer and Netflix apps, but did you know there’s many more mobile Chromecast apps on offer? They include All 4 (Channel 4), Spotify, YouTube Kids, HBO Now, Google Slides and DailyBurn and even a Chromebox-enabled Remote Desktop app.

Quality varies quite a bit, so you’ll have to be prepared to be disappointed at times, or happy to follow the download-try-remove app cycle.

To see a list of these apps visit [goo.gl/QwNsD8](http://goo.gl/QwNsD8).



▲ Sender app flowchart

### Play Games

If it’s entertainment you’re after then a Chromecast can simulate a game console experience. Just download a games to your Google Android or Apple iOS smartphone/tablet, then use this device as a game controller while the game runs on your TV.

Unfortunately, this functionality doesn’t work with every game you’ll come across, but only with certain Chromecast-enabled ones. Still there’s a sizeable section to choose from, over 100 in fact ([goo.gl/4EPKF6](http://goo.gl/4EPKF6)). Popular choices include the trivia knowledge quiz *Jeopardy*, *Just Dance 2015* and retro-style fun games like *Sonic Jump Fever*.

### Android Screen Mirroring

A display mirroring feature, similar to the PC desktop mirroring we mentioned above, is also available to Android smartphone owners. It appears as a ‘Cast Screen’ entry in the Options menu.

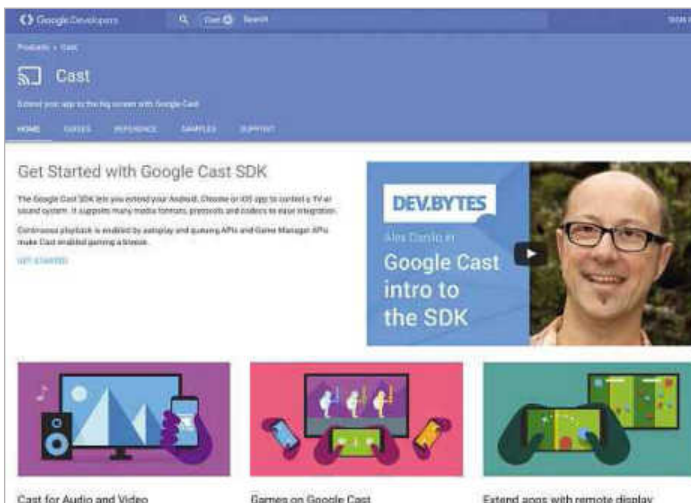
The ability to view your Android apps on the big screen is a great feature, and it offers gamers a radically different experience to a small handheld display. However, at the moment, it’s only available on certain devices installed with Android 4.4.2 or a later editions of the operating system.

### Download Chromecast Wallpaper

When the Chromecast dongle is powered up but isn’t casting anything it defaults to a scenic wallpaper slideshow, plus some casting-specific text. These wallpapers look pretty impressive despite being only 720 pixel resolution JPG files.

One enterprising member of the XDA-Developers forum has grabbed a selection of these images and created a zip file. To download the zip point your browser at [goo.gl/CK7mcN](http://goo.gl/CK7mcN).





▲ Cast developer page

## Code A Web App

At launch Chromecast worked natively with YouTube, Netflix and a few others but, as we mentioned earlier, casting Flash videos from other websites via the Chrome tab cast feature can result in a poor user experience. To help this situation in February 2014 Google announced the public availability of a Chromecast application programming interface (API) for developers. In fact there were three APIs in total, one for Google's Chrome OS (version 28+), plus ones for Google Android (version 2.3+) and Apple iOS (version 6.0+).

Using these APIs developers can now create 'Sender' apps that cast contents directly to the display, bypassing the 'Google Cast' scenario. These apps need a pre-defined receiver app that's hosted by the Chromecast dongle, but you don't need to create one of these as Google provide a number of ready-to-go examples you could employ.

## “ There are over 100 Chromecast-enabled games ”

What does creating a Sender app entail? Well, in reality it's just a Chrome extension. In other words you just need a small manifest text file that describes the app, plus some basic HTML, CSS and JavaScript code. These are combined into a single CRX file (which is actually just a ZIP file).

The official Google Chromecast Developer site at [developers.google.com/cast](http://developers.google.com/cast) has a number of editable app examples, from a simple 'Hello World' to more useful media streaming ones. What's more, you don't need anything special to begin. Any PC will do – whether it's running Microsoft Windows, Mac OS X or just about any flavour of Linux. You can code with a simple text editor, such as Notepad or vi, or a full development tool environment if you prefer. Then just download a Sender app sample and edit it to make it your own.

A more detailed explanation of the process can be found at Matthew Fuller's blog ([goo.gl/sArgqC](http://goo.gl/sArgqC)).

## Code A Sender App

As we said above the SDKs also have Android and iOS support. What this means is that mobile developers can integrate Chromecast support directly into their Android and iOS applications, as a so called 'Sender App'.

A sender app first discovers all the various receiver devices in the area, before it casts content to the one chosen – in this case it would be the wi-fi router inside the target Chromecast dongle. During initialisation a small receiver code block is sent to the receiver device. The app developer can choose which type of receiver to use for their content. At this point a cast icon becomes visible in the host mobile app. Click on this icon and the smartphone or tablet becomes a 'Cast' remote control. Now the host app can perform its encoded functionality and display the results as text, buttons, images and media content directly on to the big screen.

## Code A Receiver App

If you are a more experienced developer you might like to try coding a receiver app. It's still an HTML5/CSS/JavaScript app, but this time it runs on the receiver device, in other words the Chromecast dongle itself.

A receiver application does two key tasks. It defines the display interface for the big-screen content, and it handles message flow between the sender apps and the receiver device. These messages can be general or app-specific.

There are two types of receiver app. A Styled Media Receiver is a pre-built receiver application that provides a default media player user interface for audio and video content. By editing the associated CSS file you can customise specific elements of this user interface.

If you'd rather have full control then you'll need to develop a Custom Receiver app. This time you're free to define the full user interface and display additional types of content in addition to audio/video media. For full instructions visit Google's developer page at [developers.google.com/cast/docs/receiver\\_apps](http://developers.google.com/cast/docs/receiver_apps).

Note that anyone intending to create either a Styled Media Receiver and Custom Receiver must register their application to receive a unique app identification code. This ID is then used when making API calls. In addition developers must also register a Google Cast device in order to enable app uploading. To see the full details of what's needed to get your app up and running visit [developers.google.com/cast/docs/registration](http://developers.google.com/cast/docs/registration).

## Wrapping Up

Straight out of the box the Google Chromecast dongle is great value for money, and wireless casting is far more convenient than connecting a long HDMI cable to the back of the TV.

But, as you've seen, you can extract even more value from your £30 purchase. It can do a whole lot more than just stream video from YouTube and Netflix, or view browser tabs on the big screen. Try out a few tricks or develop your own app and the return on your investment just gets better and better. [mm](#)

## CEC Standard

The Consumer Electronics Control (CEC) standard has two main features. One is to allow HDMI devices to control each other. The other is the ability to operate multiple devices with a single remote control handset.

In practice it's possible to command and control up to 10 CEC-enabled devices, which are interconnected via the HDMI interface. These HDMI devices include computers and DVD players as well as other TVs.

Google uses this standard when communicating with the TV's HDMI port via the Chromecast dongle. Once installed the desktop or mobile computing device acts as a sophisticated software-driven controller.

# Google-Free Android

**Long-term free software user Phil Thane on the final frontier, the Android phone**

There are many reasons why you might want to avoid Google and all its works. High on many people's lists would be Google's continuing quest to find out everything it can about you, collate your browsing, purchasing, video-watching, emailing, calendar details, contact lists and map searches so as to get a better price when it sells you to an advertiser. You might object to its tax avoidance, copyright infringements, its proclaimed desire to digitise all the world's information, with the unmentioned corollary that the company will then control all the world's information.

A lot of Google's activity is easy to dodge. There are other search engines such as DuckDuckGo and IX Quick. There are other email providers – your ISP for one. There are free office suites to rival Google Docs and plenty of online storage options instead of Google Drive. You can even use OpenStreetMap. One Google product that hasn't been so easy to avoid until recently has been Google's Android OS for smartphones and tablets.

Android is based on a Linux kernel and uses various other free software tools and libraries. At heart it is an open source, free software project, but most of the development work is done by Google. When Google uses and improves a free software component, it's required to make the modified version available to the open-source community, but some of the Google software is developed purely in-house so not necessarily released as free software. AOSP (the Android Open Source Project – led by Google – [source.android.com](http://source.android.com)) is where all the free software in Android is hosted, and anyone who knows how is free to use that code as a basis for their own version of Android.

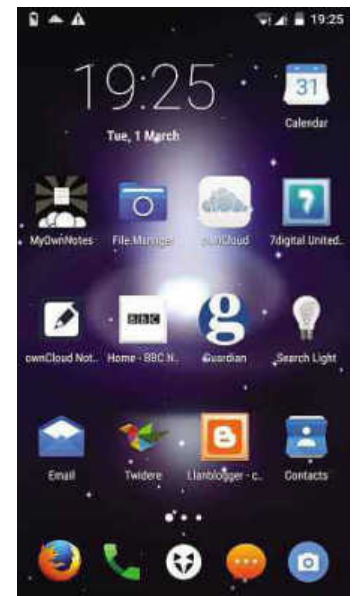
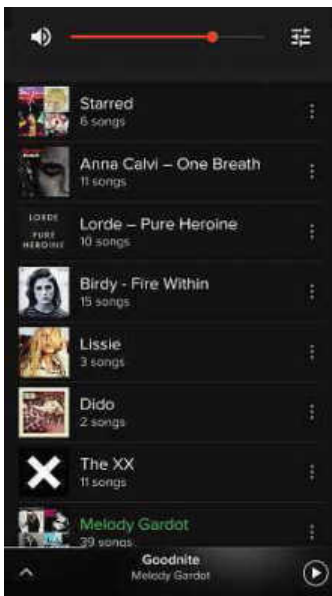
Some of the cheapest smartphones use home-brewed Android versions, generally on low-spec hardware that Google has not authorised for use with its official version, but other people can use it too. Cyanogen ([www.cyanogenmod.org](http://www.cyanogenmod.org)) began as a one-man Android hacking project that attracted hundreds of volunteer contributors. The group releases CyanogenMod, a bloatware free operating system for a wide variety of devices using a combination of manufacturers' own drivers and AOSP.

Installing CyanogenMod is not for the faint-hearted. If the phone is new it will invalidate the warranty, and if you do it wrong,



the phone may not boot at all. Despite that, many people do it, often converting cheap phones stuffed with bloatware by a phone company into something slicker and less annoying. Now there's an easier way: CyanogenOS.

CyanogenOS ([cyanogen.com](http://cyanogen.com)) is a commercial spin-off from the CyanogenMod project that develops operating systems for OEMs. Microsoft has invested in Cyanogen, probably just to annoy Google, and Microsoft is collaborating on new ways of allowing apps to interact with the OS and each other, such as integrating Skype into the phone app so that in future you'll be able to choose



to connect via the phone network or use wi-fi and VoIP from the same app. The first phones in the UK with CyanogenOS installed are the Wileyfox Swift and Storm ([www.wileyfox.com](http://www.wileyfox.com)).

Wileyfox is a new company, which released the Swift early last year and the Storm just before Christmas. Both phones are positioned at the cheaper end of the market but offer pretty good performance. The big selling point, though, is the extra security provided by CyanogenOS.

## Google-free?

The Wileyfox Storm we tested comes with the Google Play app installed, plus Chrome, Music Player and a handful of other Google 'system apps'. System apps are tightly integrated into the OS and are tricky to remove (more on that below) but you can at least remove the icons from the home screen. On first boot it pops up two registration screens, for Cyanogen and Google. We registered with the former and not the latter.

If you aren't going to use Google Play, then you are going to need a different app store. The first place to look is Fdroid ([f-droid.org](http://f-droid.org)) which hosts free, open-source apps for Android. The Fdroid app, similar to any other app store, is downloadable from the web page. On our test phone 'Install from other sources' was already enabled, and clicking on the download notification ran the installation. On some phones you might have to enable 'other sources' in the settings menu.

If you're determined to remove all traces of Google, then '/system/app mover' from Fdroid allows you to convert system apps to user apps, which can then be removed. The phone needs to be rooted and have BusyBox (a terminal emulator) installed. Some system apps may be so tightly enmeshed with the operating system that removing them will prevent the phone working. Presumably this is why Cyanogen left them in. REMOVE SYSTEM APPS AT YOUR PERIL. Much safer to delete the icons and just forget the app is there.

## Other Sources

Fdroid is the geek's choice and offers a lot of apps to do things many users would never think about, but it doesn't host many mainstream apps for the simple reason that their developers haven't released them as open source. Android apps are packaged as .apk files and a few moments on your preferred search engine will reveal dozens of sites hosting .apk files, but not all of them are trustworthy. Before downloading any app, try searching for warnings about it and for

the site you're using. CyanogenOS is better than Google's Android at telling you what an app is going to do to your device, which files it might access, which data it shares with whom and which networks it connects to. But that isn't a guarantee.

Some we have used without problems are:

**GetJar** ([www.getjar.com](http://www.getjar.com)), which is often installed on cheap imported phones. Advertising can be intrusive.

**Aptoide** ([www.aptoide.com](http://www.aptoide.com)) is an open-source installer, but the apps it hosts are not necessarily FOSS. Fdroid is actually a fork of Aptoide using the same code base but only hosting FOSS.

**Amazon** ([www.amazon.co.uk](http://www.amazon.co.uk)) hosts its own shopping app, and with that installed you can also access Amazon Underground and download music and videos. Whether Amazon is any more desirable than Google is another matter.

## Pack Your Own

If you already have another Android device with useful apps on it, then before you ditch it, install APK Extractor from Google Play or Aptoide and use that to make .apk files of your favourite apps. The files are stored on the SD card and can then be transferred to the new device and installed. We tested it with the *Guardian* app, and it pops up a message claiming that it won't run unless Google Play is updated. Ignore the message, though, and it works okay.

Before you go to a lot of trouble, check if you really need an app; many company sites these days automatically adapt to mobile browsers and work very well. A few provide their own app download site, though most just link to Google Play. [mm](http://mm)

## Music

It's easy to give Google Play a swerve when looking for music. For streaming, Spotify and Napster are pretty unbeatable, and both their apps are available from Aptoide. For downloads, try Amazon (see above) or 7 Digital ([www.7digital.com](http://www.7digital.com)). Tesco ([www.tescoentertainment.com](http://www.tescoentertainment.com)) has an uninspiring selection, but you do get Clubcard points if that's your thing. Emusic ([www.emusic.com](http://www.emusic.com)) makes a point of being staffed by people that like music, so it has a better selection of esoteric tracks than most sites.



# Alphabet Pi: Model-A

**David Briddock meanders through Raspberry Pi technology from A to Z**

Following the phenomenal success of the first Raspberry Pi, the \$35 Model B, the Raspberry Pi Foundation was keen to attract an even wider audience by offering a lower-cost entry point. In 2013, it launched the \$25 Model A, a redesigned board with fewer components to shave down manufacturing costs.

Obvious visual differences include the lack of an RJ45 Ethernet socket and a reduction in the number of USB sockets from two to

“ Today there are scores of add-on boards available, catering for a wide cross-section of activities ”

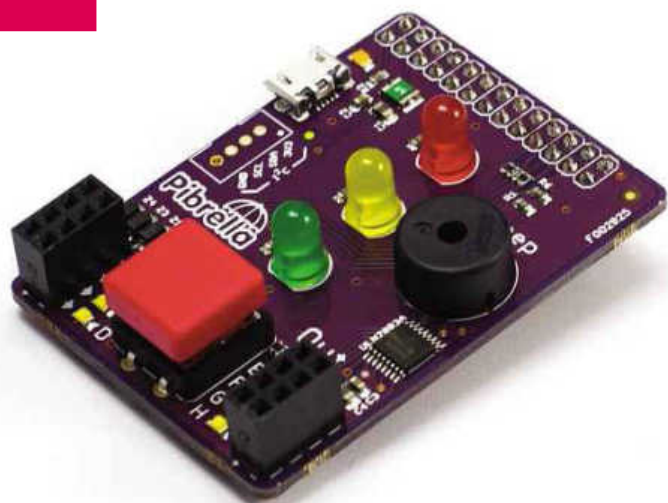
one. The board also had only 256MB of RAM – half the second-edition Model B, but the same as the original Model B.

But these omissions provide certain advantages. Without the bulky RJ45, the Model A has a much slimmer profile and significantly reduced power consumption. In fact, a Model A runs on about a third of the power required by a Model B. These attributes are highly attractive to anyone building mobile and battery-powered projects, such as radio-controlled and robotic vehicles.

## Model A+

After receiving positive feedback from the Model B+ initiative in 2014, the Raspberry Pi Foundation decided to give the Model A a similar design makeover. The price was reduced too, now down to just \$20.

Named the Model A+, it shares a number of features with the Model B+. For example, it has the same 40-pin General Purpose Input Output (GPIO) connector, the sturdier micro-SD card socket and four mounting holes. Power consumption levels were lowered still further, and the audio output benefited from a dedicated low-noise power supply.



Most interestingly for the maker community, the redesigned layout, which involved repositioning the USB socket and 3.5mm audio jack, means the Model A+ board is actually 2cm shorter than the Model A.

## Add-on Boards

The amazing success of the Raspberry Pi and its versatile GPIO connector has encouraged many thousands of owners to experiment with electronic circuitry. They've added LEDs, buttons, joysticks, sensors, motor controllers, analogue-to-digital converters, mini-LCD displays and much more.

Electronic designers noticed what was going on and recognised a business opportunity. They began to create a range of add-on boards that simply snapped onto the Model B or Model A using the 26-pin GPIO connector. The idea was to provide newbies an easier entry point into the world of hardware hacking.

Add-on boards help Pi owners create home automation systems, build a security camera, construct a weather station or control a motorised robot. Many also offer built-in current protection, which ensures a circuit can't be accidentally overloaded and damage the Raspberry Pi.

Today there are scores of add-on boards available, catering for a wide cross-section of activities and projects. Some popular examples are the Pibrella ([pibrella.com](http://pibrella.com)), PiFace ([piface.org.uk](http://piface.org.uk)), PiLite ([goo.gl/ioE4C3](http://goo.gl/ioE4C3)) and Adafruit's Pi Cobbler Breakout kit ([goo.gl/tLf6b](http://goo.gl/tLf6b)).

However, the introduction of the 40-pin GPIO connector, for the Model B+, Model A+ and Pi2, changed the game, as it led to the related Hardware Attached On Top (HAT) initiative. Snap on a HAT and the Pi recognises which board is attached, then automatically loads the appropriate drivers and setup files. Now board designers can open up Pi hardware hacking to an even wider audience. [mm](#)

# Remembering...

## Sinclair ZX Spectrum +2

### David Hayward has fond, but painful memories of his Speccy

**A**fter Sir Clive sold his company name to Sir Alan (although he wasn't a Sir back then), it was a significant blow to the home computing community. What was to happen to the much loved Spectrum? Where next for the games? The future remained uncertain.

For a mere £5 million, which is peanuts by today's standards, Alan Sugar's Amstrad became the new owner of the Sinclair brand and its range of home computers. That was in April 1986, and it wasn't long before we began to see what was to become of the Spectrum computer through the pages of Crash and other such notable magazines of the time.

The ZX Spectrum +2 was the first of the Amstrad Sinclair computers, launched in 1986 for between £150 and £200. Its remarkable likeness to the Amstrad CPC 464 wasn't really surprising. After all, the company had seen some success with that particular model and layout.

Of course, it was a different beast to any Spectrum that came before it. The spring-loaded keyboard, built-in dual joystick ports and the attached tape recorder – the Datacorder – were a startling new look from the old 'dead flesh keyboard' and previous 'Toastie' versions. But it wasn't a bad new look.

Although there were some reservations at first, the Spectrum +2 actually proved to be a far more reliable and effective home computer than its older siblings. The improved manufacturing process from Taiwan, the first time a Spectrum had been made outside of the UK and better testing meant that this model was more stable and significantly more reliable.

It was slightly faster (3.5MHz), it included the wonderful Yamaha AY-3-8912 sound chip, and the familiar 128K menu had changed slightly too, with the removal of the Tape Testing option. Although there were some problems with the ROM addressing with older Spectrum games and the fact that the tape deck did occasionally die, the +2 proved itself to be one of the best home computers of the time.

#### Its History

After spending £5 million on the Sinclair brand, Amstrad needed to come up with something new, yet familiar enough to bring the already established Spectrum user base on board, while tempting new users to spend their cash on this model rather than the still magnificently popular Commodore.

The first batch of Spectrum +2's were sold with a collection of interesting extras, such as the James Bond 007 Action Pack, with a light gun. This was quite a change in direction, as the Spectrum was now being regarded as a gaming machine, compared to Sir Clive's original educational-only platform.

It was a clever move on the part of Amstrad, and it sold around a quarter of a million units in the first year – less than Amstrad expected, but still enough to turn a profit and continue the production of the Spectrum into the +2A, +2B and finally the +3 models. There was even a rumour of a +4.

However, despite the new lease of life the Spectrum was enjoying, the end of 8-bit home computing was rapidly approaching. The + models of the

#### Did You Know?

- The +2A and +2B model motherboards differed slightly due to production being moved from Hong Kong to Taiwan.
- There was a 32KB ROM, split into two 16KB ROMs for the 48KB and 128KB Spectrum modes.
- Replacing the Sinclair Research copyright notice on the screen changed the memory addresses and caused problems with some games.
- When the tape drive finally died on my +2, I could get it working by removing the lid and gripping the tape against the heads and the front of the Spectrum while the games loaded. As a young teen, I developed remarkable forearm strength.

Spectrum were eventually dropped in favour of 16-bit machines.

#### The Good

A well designed machine, reliable and fairly cheap too.

#### The Bad

Problems with early ROMs meant some older Speccy games didn't work. The occasional hissy fit from the Datacorder. Twiddling Azimuth screws.

#### Conclusion

The Spectrum +2 was a personal favourite of mine and one I still dig out from time to time.



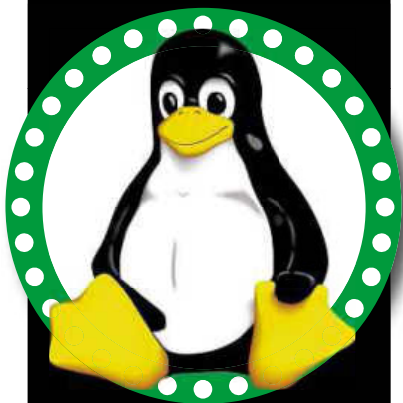
▲ The grey chassis of the Spectrum +2. Bless its little rubber feet



▲ The +2A was somewhat improved, but still had some Datacorder problems



▲ The +2B was the last tape based Spectrum to be sold. After that came the +3



David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

# Linux

# Astronomy On Linux

## Plenty of space for space with Linux

A few years ago, I treated myself to a telescope, after spending more than half an hour taking the bins out on a particularly clear night.

I've always had an interest in what's up there, but it wasn't until I got my telescope that I really began to appreciate just how much there is to view even from the small area of a back garden in deepest Lowestoft.

I'm no professional astronomer, so I need some help when it comes to locating and identifying the visible planets, stars, galaxies and so on that you see on a clear night just before you trip over the cat. To that end, I use a collection of programs to aid me. Some of these are on my tablet, since it's easier to carry around, and others are on my Linux laptop, which can be connected to the telescope and used as a finder.

Anyway, I thought I'd share them with you, since the nights have been so clear recently, and now is a good time to get outside for some star gazing.

### Google Sky

Although it's often frowned upon by clever amateur astronomers, Google Sky is my first go-to app for helping me locate a particular heavenly body.

If I see something that I'm not too sure of, it's a simple enough job to power up my tablet or phone, launch Google Sky and point it in the direction of the thing I'm looking at.

Nine times out of ten, I won't need to calibrate the compass sensor or anything, and it'll tell me what the object is.

From there, it's easy to quickly get my binoculars out or take a little longer to set up the telescope.

### Celestia

I don't usually use Celestia for proper star gazing. In truth I use it to explore the solar system and to see what's out there and what's newly discovered by Nasa and earth-bound observatories.

You can, of course, use it for traditional astronomy, but Celestia goes one better by allowing you to travel to the planet you're currently looking at and getting all sorts of information about it. Further to that, you can also travel outside of the solar system and even outside the galaxy to the outer reaches of the visible universe.

Of course, a lot of that is theoretical, but considering it's theorised by far more clever people, I'm willing to take it as

reality. Try travelling to EGSY8p7 and looking back at our own sun; it's only 13.2 billion light years away.

### Stellarium

Stellarium is the main astronomical program I use. Not only can I plan out a future night's viewing, if the weather holds, but I can also connect the telescope and track any of the objects that are visible from my little patch of earth.

It's a big program these days, with hundreds of megabytes of extra star data to download and use, and it can get grind slowly if you're using an older laptop. However, it's an amazing tool, and even if you don't own a telescope, it's a great educational resource.

If you have any astronomy tools for Linux you think are worth checking out, then please email in and let us know.

▼ *Astronomy is always better with a bit of Linux*





# A Bit Of A Character

**Once, Macs had personality, but Craig Grannell reckons that's been stripped away in favour of minimalism**

I was recently tasked with writing a feature for a magazine that realised Apple was about to hit 40. The idea was to trawl through the company's history and talk about the best bits. Naturally, I spent a chunk of time on Wikipedia, exploring a timeline of hardware, from the original Apple I, right through to the most recent versions of the Mac, iPhone and Apple TV.

As often happens when I look through pictures of old Apple hardware, it was the iMac G4 that really stood out. I remember that machine when it was first released and how it made everything Apple had previously created look stuffy and boring by comparison – including the original iMac. Dispensing with the older iMac's fishbowl stylings (which were a limitation somewhat enforced by a CRT display), the revamped iMac had more in common with Luxo Jr., the excitable bouncing lamp in Pixar's classic animation.

Whereas the original iMac had been a mainstream home computer with at least some style, here was one with personality. The screen was akin to a face, attached to a metal neck that could be moved in any direction. The unit was light, smart and fun, although the design was not best suited to the 20" version, which looked top-heavy.

It's probably that final incarnation of the iMac G4 that explains why the design went no further. Desktop all-in-ones continued to rampage onwards –

bigger was better as far as the display went, and everything else had to be hidden from view. Accordingly, the model's successor – the imaginatively titled iMac G5 – became a flatscreen with a chin, supported by a sleek L-shaped aluminium stand. It could tilt a bit, but short of nailing the thing to a sliding wall mount, the iMac's 'face' had lost its freedom.

Moreover, the iMac had also lost its personality and would never get it back. Every new release in the line has merely bowed to Apple's ongoing infatuation with minimalism and thinness. You get the feeling the company won't be entirely satisfied until it's released an iMac you can't see side-on, and which gives you a nasty paper cut whenever you try to move the screen.

Of course, personality isn't at the top of my list when it comes to home computing. I'm perfectly happy with my nice-but-dull iMac, which has to date been quite reliable, quiet and unassuming, sitting on a desk like a sterile lump of metal and glass. But every now and again, I do get the temptation to bung 'iMac

G4' into an eBay search to see what's out there. I did for a while think an old iMac G4 could somehow be a useful addition to the office. My reasoning was that it could perhaps be a telly or a jukebox. Then I came to my senses and realised that with the ancient version of OS X it would be saddled with, this quirky iMac would just be another piece of dead kit, barely used and taking up space.

So my office remains resigned to boring Apple kit, with every new piece of hardware offering more capabilities but less character than its predecessor. The logical conclusion is that computers will essentially be invisible within a few generations, anything imaginative going on inside the display rather than with the hardware's design. This is a crying shame and the price of progress, but it does raise one question: how bored will Apple's chief design officer, Jony Ive, be in a few years if his job mostly entails drawing rectangles rather than truly thinking different?

▼ *Macs used to have a sense of fun, before they became sterile rectangles of glass and metal*



**Craig Grannell is a writer, designer, occasional musician and permanent loudmouth. He's owned Macs since 1996, when Apple was facing certain doom, and is therefore pleasantly surprised by its current success. Find Craig on Twitter at @craiggrannell**

# Mac



# Rest In Show

**Ian McGurren looks over some of the alternative highlights of MWC 2016**

Ian is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

# Mobile

It's the last of the big trade shows and, yes, we got the expected big announcements from the big companies about their big phones, but what of the more unexpected highlights?

Once one of the world's biggest PC manufacturers, HP, like other similar companies, has seen its market share eaten away by the emergence of smartphones and tablets. It's tried its hand at both in the past, but that hasn't been met with anything like the same success it had with PCs in the enterprise sector. But it's not stopped it trying, and with phones now becoming powerful enough to be considered personal computers, it has returned to the phone market: not with Windows Mobile but with Windows Phone 10 and, importantly, with its interpretation of Continuum, the technology that turns a phone into a PC. The device – the Elite X3 – is a very well made 6" smartphone which, like the Lumia 950, can be docked on a monitor (or custom 'laptop' type screen and keyboard) and run what is basically Windows 10. It's good to see Continuum getting some more support, because while it might not be the future in the consumer world, it's ideal for enterprise.

Slightly more unusual is the hot product from boot and heavy machinery manufacturer CAT. I say hot; it's more a product that can detect if something is hot or, indeed cold, as it's a regular smartphone with a thermal camera. CAT has released mobiles before, albeit mostly no frills but with extreme protection for rougher workplaces – think if Wickes

made phones. Here the same level of protection is present, but the thermal camera is a first, and on a consumer device it's quite a clever USP. CAT say it'll be very useful for the building trade (find wires, hot pipes and so), and could even be helpful for farmers with animals.

Talking of which, it was cows that were the focus of attention for Fujitsu's latest product for the Internet of Things. Humans have been happily tracking themselves for ages now, and recently we've been able to see a bit more than just our location and distance. So what's to stop the same technology being used on other creatures with legs? Using Microsoft's Azure cloud service, farmers are able to not only keep a real-time eye on their herd, but also on other aspects that will help understand when to milk them, and even where some may be in their estrus period, meaning possible controlled insemination to promote higher conception rates. There's a sentence you didn't think you'd read in Micro Mart. And before you say it, no the trackers aren't made by Moov...

Finally from milk to er, milk teeth? Sorry, not the best link. In the past, you may have seen the rather fancy toothbrushes from Oral B that hook up with your phone via Bluetooth, giving you a countdown and such to promote the best oral health. At MWC, Oral B showed its latest range, which now has the ability to determine the amount of the mouth that's had a proper clean, and show you where you've missed out. It also gives visual feedback of pressure (too much pressure is one of the causes of receding or damaged gums), as well as the standard countdown. There's also some social aspect, but really, people post enough waffle on social media without elaborating on their twice-daily brushing efforts.

For the visual feedback, you'll need to have your phone in eyesight too, but if your oral health is important enough to you to spend £150 or so on an electric toothbrush and also take your phone into the bathroom with you, then this is pretty much the only product for you.



# Fun Per Second, Surely?

Andrew Unsworth checks out AMD's new hardware releases

**W**e're approaching that time of the year when new computer components, particularly graphics cards and processors, start to be dropped on a possibly unsuspecting but most definitely interested public. At the time of writing, news of the AMD A10-7890K and the Athlon X4 880K has broken, although we won't be able to buy them until the end of March.

The A10-7890K is AMD's latest accelerated processing unit (APU), which is what it calls its CPUs with built-in Radeon graphics processors. These chips have always been something of a bargain, and while the graphics power of the built-in GPU hasn't been as good as a discrete card, it's been better than you'd expect and perfectly capable of light 3D gaming.

The A10-7890K is a four-core chip with eight GPU cores and a 95W TDP. Base clock speed is 3.9GHz, with frequency rising to 4.1GHz with turbo boost. However, the A10-7890K is unlocked, so it can be overclocked to provide even higher performance. The retail version of the A10-7870K comes with the Wraith cooler, which AMD says is near-silent.

AMD says the Athlon X4 880K is the "fastest multi-core Athlon processor ever released" and cites its 4.2GHz maximum turbo boost speed as evidence, although the previously fastest Athlon had a 4.1GHz, so the frequency increase isn't that extreme. The four-core chip has a generous base frequency of 4GHz, and because it's unlocked, owners will be able to overclock it so that it runs at even higher frequencies. The

Athlon X4 880K comes with a promising new heatsink and fan assembly called the 125W Thermal Solution too, which is the Wraith cooler with the fancy illuminated surround taken off. The 125W Thermal Solution should operate near-silently, too. If it provides enough cooling to allow a meaningful overclock, then all the better.

AMD has published benchmarks for 1,440p and Ultra HD gaming with an X4 880K, coupled with a Radeon R7 370 graphics card, and the figures look respectable. AMD's benchmarks claim 66.9 frames per second in *Counter Strike: Global Offensive* at a 4K resolution, and 126.7fps at 1440p. AMD says these benchmarks were taken with the game running at 8x MSAA and with the highest detail settings enabled.

I don't have UK prices just yet, but the US price for the A10-7890K is \$165, which means it should sell for around £118 going off conversion rates at the time of writing – assuming it's a straight conversion, of course.

Another neat addition to the line-up is the bundling of the currently available AMD A10-7870K with the 125W Thermal Solution. Any additional cooling is great, but the promise of nearly silent performance will be a big draw for those who want a decent amount of power but don't want their gaming or work interrupted by the sound of an angry hairdryer.

AMD says all the new products will be on sale at the end of March, so the temptation to

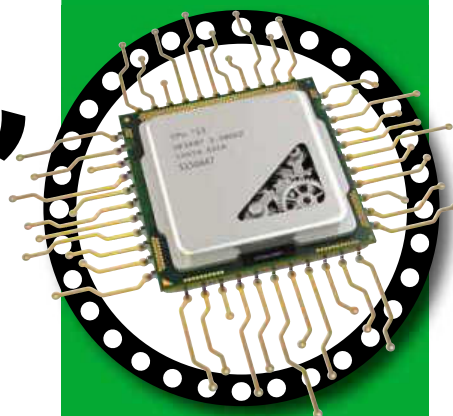


buy one of them so soon after pay day will be immense. In my experience, the combination of an AMD A-series chip and an SSD has always produced a snappy, responsive and relatively powerful low-cost computer. The ability to build a bargain PC around them is especially true given the relatively low price of AMD motherboards.

The A10-7890K is particularly compelling because, when combined with a £40-£50 liquid cooler, the ability to overclock it makes it a (potentially, depending on UK pricing) wallet-friendly chip for enthusiasts that want to tinker but don't want to risk frying a £200-plus CPU.

## Pi Time

Also fresh out is the Raspberry Pi 3, which I'm sure has been covered extensively elsewhere in the mag. However, it's worth saying that if you haven't already experienced the joy of Pi, then you should definitely put your hand in your pocket and shell out for one. It costs less than the price of a meal out, so even if you only tinker with it for a month or two before passing it on to someone else, it's been a worthwhile investment. I must admit that I don't give my Pi 2 the attention it deserves, but I'll be rectifying that in the next few months.



Andrew Unsworth has been writing about technology for several years, he's handy with a spanner, and his handshaking skills are second to none

# Hardware





Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

# Gaming

## Cult Following

*A peaceful religious commune, or something more sinister? The answer will vary from game to game in the top-down action-stealth-em-up, The Church And The Darkness*

This week, Ryan takes a look at a top-down action stealth game with a unique premise, and checks in on the progress of the open-world title, *Worlds Adrift*...

### Plug & Play

If videogames are based on true events at all, they usually take inspiration from major conflicts like World War II. Every so often, though, game designers will mine rather more unusual moments from history for ideas; the recent indie game *Firewatch*, for example, is partly about the blaze which swept through Yellowstone National Park in 1988.

Then there's forthcoming action game, *The Church In The Darkness*, which has a particularly unique premise. Set in 1970s South America, it's about an ex-cop who aims to infiltrate a secretive cult to find his nephew; while developer Paranoid Productions doesn't mention Jonestown by name – it simply says that the game is "based on true events" *The Church In The Darkness* has clear parallels with that organisation.

What's striking about Paranoid's game, however, is that its backstory isn't window-dressing for a heroes-versus-villains shooter. Instead, it uses procedural generation in a highly original way: each time the game begins, the layout of the church and its grounds changes, and so too do the motivations of its leaders and disciples. This means that the cult could be dangerous

in one game and benign in another, which in turn raises questions about the protagonist; is he rescuing his nephew from a dreadful fate, or is he actually persecuting an innocent group of people who want to live in seclusion? The game leaves this up to the player to decide.

"Every play through of *The Church In The Darkness* offers a unique version of Freedom Town with different character personalities and a shifting narrative told through investigation, observation, and action," Paranoid write in the game's announcement. "How dangerous are the [church's leaders]? Who are your allies and enemies? How far will you go to uncover the truth and save these people?"

Viewed from above, *The Church In The Darkness* is an evolution of the *Metal Gear* concept, in that the game gives players the freedom to behave as stealthily or violently as they like; but as Paranoid warns us, "You'll have to live with the consequences of those choices."

The cult's leaders will be played by Ellen McLain and John Patrick Lowrie, whose voices you'll have heard in *Portal* and *Team Fortress 2* respectively. Here, their tones will boom out from the complex's

public address system, giving the player vital clues about the cult's beliefs and intentions – sinister or otherwise. It's still early days for *The Church In The Darkness* as it's not scheduled for release until 2017, but its concept alone hints at an intelligent and potentially disquieting game. You can find out more by visiting [tinyurl.com/gwbj5z8](http://tinyurl.com/gwbj5z8).

### Online

The last time we checked in on the fantasy MMO *Worlds Adrift*, we discovered an online shooter where players take to the skies in wooden flying ships. It looked like a lot of fun, but we've more recently learned there's far more to the game than firing cannons or swinging from ship to ship with a grappling hook. *Worlds Adrift* takes in plenty of exploration too, as a new trailer ([youtu.be/yjvvaChwHy4](http://youtu.be/yjvvaChwHy4)) points out; with said grappling hook, you can traverse the leafy islands in search of treasure. It's positively zen compared to the game's aerial battles, and gives a fresh perspective on developer Bossa Studios' ambitious plans.

*World Adrift* offers a lush persistent world that will constantly change as players interact with it. Those aerial battles will leave the husks of



▲ Build airships. Blow up airships. Or just roam the landscape, chopping down trees. Just some of the pastimes in Bossa's online game, *Worlds Adrift*

ships strewn across the ground; left untouched, it'll gradually rust and decay, though debris can also be sifted through for loot.

Like Hello Games' forthcoming *No Man's Sky*, *Worlds Apart* opts for a painterly aesthetic over photo-realism. Its procedurally generated forests and hills having pleasingly soft edges, and the game also shares the free-form quality of Hello Games' space sim. Players seem to be left to approach the game in a way they see fit; the game's central focus is the construction and battling of flying ships, but how you actually go about this is up to you.

Gameplay footage released last year showed a pair of players building a huge dirigible together, which looked both fiddly and

fun. Starting with a basic metal frame, players add components (i.e. engines, cannons and panels) from a pop-up menu, and attach them to the frame piece by piece. If *Minecraft*'s virtual Lego, *Worlds Adrift*'s closest real-world analogue appears to be kit-bashing – the act of taking bits of model tanks and planes and sticking them together to make something new and fantastical.

How much fun this will be in practice remains to be seen; a recent update to the game's alpha build, saw a protection system added to prevent rival damage to ships before they're out of dry dock, which sounds like a wise move.

Once finished, *World's Adrift* could prove to be a nail-biting

experience; can you imagine spending hours crafting a huge ship with your friends, only to see it go down like the Hindenburg during a screaming air battle? It sounds brilliant and heart-rending at the same time.

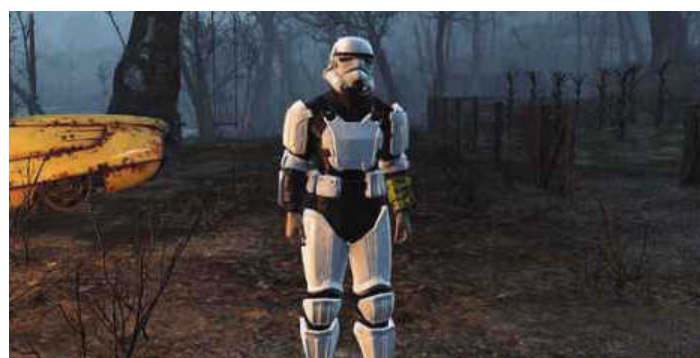
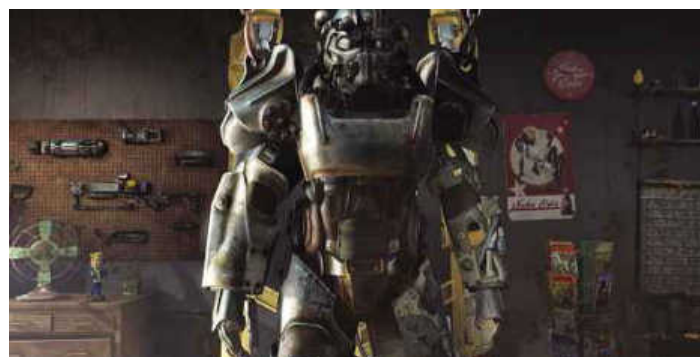
Find out more about over at [www.worldsadrift.com](http://www.worldsadrift.com).

## Incoming

You may remember that, when *Fallout 4* launched last year, it did so without any mod tools. The reason, Bethesda's Pete Hines explained, was that the game's developers wanted to concentrate on getting the game itself out of the door before they worried about the construction kit element. Thanks to game designer Todd Howard, though,

we now know when the *Fallout 4* edition of GECK (or Garden of Eden Creation Kit) will appear – sometime in April, "Between the first two DLCs".

"People are beta testing it," Howard adds. Of course, the lack of official tools hasn't prevented players from tinkering with the game already – the hundreds of mods uploaded to Nexus Mods so far include higher-res textures, a flamingo companion and a home defence robot. But GECK's flexibility will mean that completely overhauling *Fallout 4* will be in the reach of PC users everywhere. Once GECK's out in the wild, expect to see some ingenious (and very strange) *Fallout 4* conversions to follow in due course.



▲ Waiting excitedly for the *Fallout 4* edition of GECK? You've not much longer to wait: Bethesda says it'll be out in April



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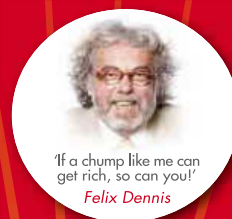
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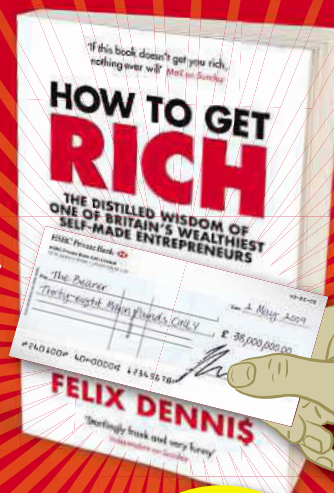
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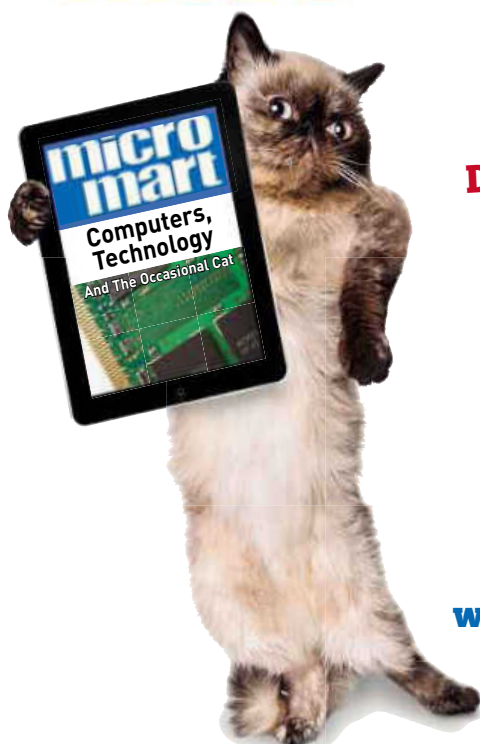
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Tel: Gordon (01314) 660205  
Email: scobie09@gmail.com

**HP Photosmart C4585 All-in-One multifunction colour printer.** Perfect condition. Includes software and manual. £20.00  
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E-mail: scobie09@gmail.com

**Brand new USB brackets** Add 2 extra USB2 ports to your computer at little cost and very simple to fit cable connect onto the motherboard and uses a spare slot on the back of your computer no drivers required please email or call me for a price  
Tel: David (01616) 888119  
Email: pcmadnessltd@yahoo.co.uk

**Laptop Hard Disk Drive. Fujitsu.** 20GB. Excellent condition: £10.00.  
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E-mail: scobie09@gmail.com

**Laptop RAM 2x1GB PC3-8500 DDR3 1067MHz** from a working mac book pro but can be used in other laptops this is the quickest way to boost you laptop speed please email or call me for a price  
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**Windows 7 Computers** Fresh install of Windows 7 this Computer great for gaming, office work, surfing the net, watching movies generally a good all round system from £150 +p&p might also have laptops price on request please email or call me for more information  
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**Sapphire ATi Radeon HD3850 512MB 256Bit GDDR3 AGP 8x DUAL DVI/HDTV Graphics Card** to of the range AGP GFX card i beleve it supports DirectX 10 great for gaming, watching movies, video editing, CAD/CAM applications and any other hight demand gfx programs generally a good all rounder £80 +p&p please email or call me for more info

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#### **Windows XP Pro Computers**

Fresh install of Windows XP Pro this Computer great for gaming, office work, surfing the net, watching movies generally a good all round system from £100 +p&p might also have laptops price on request please email or call me for more information

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**Motherboard Bundle** 3Ghz AMD 64bit CPU 512MB Ram 5xpci 2xSATA 2IDE 1Gb LAN 6 channel sound firewire COMES WITH DRIVER CD AND MANUAL great for gaming, office work, surfing the net, watching movies generally a good all round system spec can slightly be changed if required £35 + p&p please email or call me for info

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Email: pcmadnessltd@yahoo.co.uk

**Fans** different sizes and types please email or call me for a price

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**Laptop CPUs** mainly Intel different speeds please email or call for prices

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Email: pcmadnessltd@yahoo.co.uk

**Motherboard Bundle** 3.2Ghz Intel 64 bit CPU 1GB Ram 2pci-e 2xpci 2IDE 2SATA 8usb ports LAN 6ch sound COMES WITH DRIVER CD AND MANUAL Great for gaming, office work, surfing the net, watching movies generally a good all round system spec can slightly be changed if required please email or call me for a price

Tel: David (01616) 888119 Email: pcmadnessltd@yahoo.co.uk

## **HARDWARE WANTED**

**Trying to breathe life back into an old machine? Why not submit a wanted ad to MicroMartClassifiedAdverts@gmail.com and see if any of the thousands of computer enthusiasts who read the magazine each week have what you're looking for?**

**WANTED: Tape drive backup.** Either DAT320 or later generation LTO system in good condition. Please contact me.  
Tel: (07949) 407022 Email: tape.20.odaily@spamgourmet.com

**WANTED:** You bought a Corsair water cooler, with a square block. You fitted it to your Intel processor. You want to make a few pounds from the spare A.M.D. bits? Contact me!  
Email: johnrpeel@gmail.com

**WANTED:** Gigabyte GA-Z77X-D3H motherboard wanted.  
Email: johnbeiry@gmail.com

**WANTED:** PC Tower case (beige colour if possible) to rehome an Amiga A1200 vintage computer. The Amiga motherboard is H 410mm x L 190mm (H 16" x L 7.5"). PSU not an issue but if available 250 watt more than enough.  
Tel: Bill (07742) 061569 or (02641) 769503.

**WANTED:** 3G dongle for Archos 80 G9 tablet.  
Email: alancox28231@gmail.com

## **SOFTWARE FOR SALE**

**Sim City 2000:** Boxed and original. Classic gaming. £15.00  
Tel: Gordon (01314) 660205 Email: scobie09@gmail.com

**Adobe Photoshop Elements and Premiere Elements 12** Full Version - Windows/Mac. Original Boxed CD with unused product key. £47.50  
Tel: Ian (01932) 856971  
Email: a2345@btinternet.com

**PCB design software.** 127 layers, schematic entry, PCB entry, PCB to Gerber file converter, output to printer. £9.99  
Tel: Nigel Wright (07967) 527693  
Email: cresswellavenue@talktalk.net  
**Microsoft Office 2013.** Original Software only £100.  
Tel: Gordon (01314) 660205  
E-mail: scobie09@gmail.com

**Cyberlink PowerDVD 12 Standard.** Runs under Windows 8, 7, Vista or XP. Original CD with unused product key £7.50  
Tel: Ian (01932) 856971  
Email: a2345@btinternet.com

**Nuance Omnipage 18.** OCR; Windows 8, 7, Vista or XP, Original CD with unused product key £25.  
Tel: Ian (01932) 856971  
Email: a2345@btinternet.com

**Acronis True Image Home 2012.** Bootable CD. Application runs under Windows 8, 7, Vista or XP. Original Acronis CD with unused product key £5.  
Tel: Ian (01932) 856971  
Email: a2345@btinternet.com

**Norton Family Premier 2.0.** Runs under Windows 8, 7, Vista or XP, Original Symantec unused product key £15.  
Tel: Ian (01932) 856971  
Email: a2345@btinternet.com

## **SOFTWARE WANTED**

**Good Text to Speech program** WinXP or 7 to read ebooks aloud for a pensioner with few resources.  
Tel: Wilf James (01767) 699809

**Wanted:** PictureToExe software, for making picture shows.  
Tel: (01202) 610602  
Email: ivor.mary@talktalk.net

**Wanted:** Quicken 2001. I desperately require a copy of QUICKEN 2001, UK Edition. I need to reinstall the program but have lost my original installation CD.  
Email: david.maddams@icloud.com

## **IMPORTANT BUYING ADVICE**

**We work very hard to police our classified ads, and make them as secure as possible.**

**However, please do your bit too and use the following guidelines:**

- **Never - NEVER** - pay by bank transfer or post out cash, unless you know the trader already, or are sure it is okay to do so. Pay by cheque, Paypal, Nochex etc wherever possible.
- Be wary of anyone who insists on you paying by the above methods if in doubt, get us to check them out by mailing editorial@micromart.co.uk
- Keep copies of all correspondence
- When sending out goods, at the least obtain a certificate of posting from the Post Office

**If you are in any doubt, feel free to send us a mail via editorial@micromart.co.uk.**

**Every year, thousands of successful transactions take place through our classifieds, and that's just how we like it.**

**Help us help you keep them one of the safest and most secure places to buy and sell computer kit.**

# ASK AARON



**Meet Aaron Birch.** He's here to help you with any general upgrading, software and system building problems. He's got advice aplenty and you're very much welcome to it!

Send your questions to:  
Aaron Birch  
Micro Mart  
Dennis Publishing  
30 Cleveland Street  
London  
W1T 4JD

Contact Aaron by email at:  
[aaron@micromart.co.uk](mailto:aaron@micromart.co.uk)

Please try to keep your queries brief and limit them to just one question per letter, simply so we can squeeze in as many as we can each week. Please include relevant technical information too.

# Aaron

## Slot Machine

Thank you for solving a recent problem but (and hope I'm not boring you), another has evolved. The motherboard in questions is an HP Nutmeg P Foxconn derivative with a Pentium J2900 CPU. It has two memory slots.

With memory slot one fitted with a 4GB module (as purchased), the PC works fine. If I transfer the existing memory module to slot 2, the PC will not boot up.

Does slot 1 have to be working for memory slot 2 to accept another 4GB of RAM, or is the motherboard playing up?

*For most motherboards, it really shouldn't matter which slot you use unless you're using two modules. Most boards have matching pairs of slots, which are denoted by different colours. This means a motherboard supports dual channel RAM, and to make use of this, you need to install the two matching pair modules in the same coloured slots, usually slots 1/3 or 2/4. Many would say you should always use the slot furthest from the CPU for best results, which usually means 2/4.*

*However, with only one module, there's no real reason to pick any slot in particular, although personally I always simply use the slots in order if*

*dual channel isn't an issue. All slots should work, as long as the memory is detected in your BIOS.*

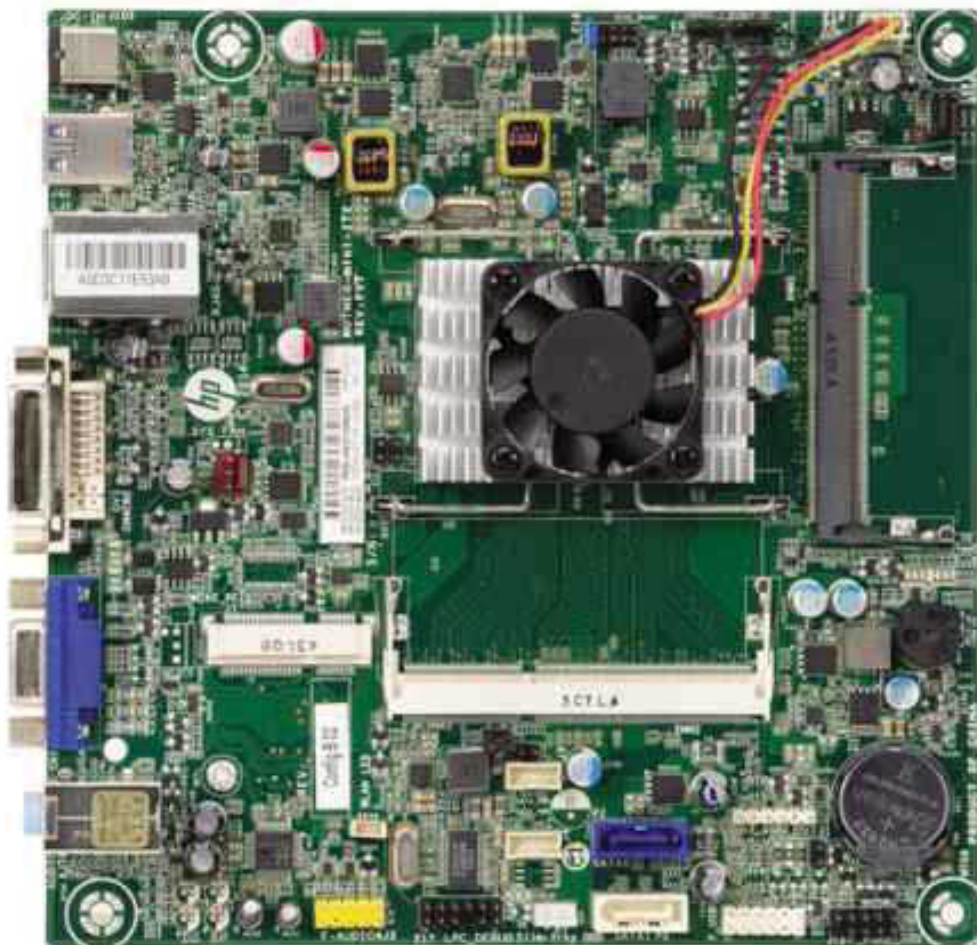
*That said, I can't say this is written in stone, as there are way too many motherboards out there for such a blanket statement. The best course of action would be to consult your motherboard documentation, as some do state specific instructions for installation. This may vary from board to board.*

*One thing I would check in your case is your BIOS. You said the PC won't boot with the RAM in slot 2, but does it get to the POST? If so, go into the BIOS and check to see if the RAM is detected. If it isn't, have a look for any options that may help.*

*Your issue could be down to a faulty RAM slot, as the module works fine in Slot 1. The RAM slots for this particular motherboard are a little more delicate, using the laptop-style slot instead of the standard desktop motherboard slot, so damage may be an issue. That said, laptops are often different, and slots are often used in order, and this Mini-ITX form factor board may be the same.*

*Unless you're planning an upgrade, though, there's no reason to move the RAM to another slot, so slot 1 will suit your needs.*

▼ **RAM slots aren't usually picky, unless you're using dual channel sets**





## Not So Sweet Sixteen

I would be most grateful for your help regarding my problem to get my copy of *The Concise Oxford Dictionary 9th Edition* PC CD-ROM to load onto Windows 10, which I have reluctantly just moved over to.

When trying to install, I'm advised that the app is 16-bit and not compatible with Windows 10 (which I know is 64-bit). I'm unable to find out what to do in the absence of a reissue of the COD in 64 bit. I do not wish to use the internal Windows dictionary. Can you please advise what I have to do to convert the COD to whatever bit will work with Windows 10?

**John**

*Sadly, getting 16-bit apps to work on a 64-bit system is difficult, and in some situations, even impossible. The issue here is the age of *The Concise Oxford Dictionary 9th Edition*, which was released a long time before Windows 10 and 64-bit systems. It's easier to get older programs to run on 32-bit systems, but 64-bit creates a much more difficult situation.*

*I'd usually suggest the use of Windows' compatibility mode options, which you*

*can find by right-clicking the application's .exe file, but this will almost certainly not work. You can try, but be prepared for it to fail.*

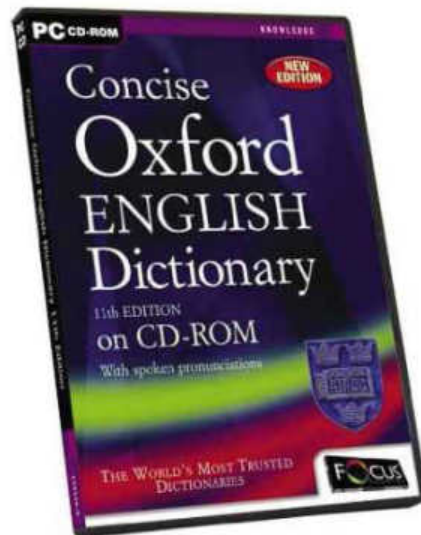
*One possible option is to use an emulation tool like DOSBox ([www.dosbox.com](http://www.dosbox.com)). This is able to run older programs within more up to date versions of Windows, even DOS applications, and 16-bit programs on 64-bit versions of Windows. DOSBox is free, so it'll cost nothing to give it a go.*

*Another option would be to use virtualization, using a tool like VirtualBox ([www.virtualbox.org](http://www.virtualbox.org)). With this, you could set up a virtual PC and install an older copy of Windows on to it that naturally supports your program. With this, you'd be able to install and run the software as normal. This requires an actual copy of Windows with a license, space and resources from your PC, and the time to set up, so DOSBox may be a far more accessible and practical option. With an older version of Windows running on your system in a virtual machine, however, you'd be able to easily run any older program.*

*The only other real options would be to upgrade to a more recent version of the program, or an alternative dictionary. There are many free options around,*

*but *The Concise Oxford Dictionary 11th Edition* can be found online for next to nothing if you look around (when we had a peruse, we discovered you can get it for as little as 66p on Amazon).*

▼ *Some older software simply won't work on Windows 10, but with emulation there's usually a way*



## Good Guy Torrent

I keep seeing Bittorrent mentioned online and in magazines, including *Micro Mart*. I understand it's a way to download files, and resume them when needed, as well as sharing data. What I don't understand is why you mention it when it's only used for illegal downloads, and why it's not been banned before now. Care to explain?

**Ste**

*Bittorrent certainly does have a bad reputation, and for good reason. It's undeniably the most popular method of downloading pirate content, and the majority of Bittorrent traffic likely falls into this category. However, there's also a large legitimate take up of the tool that makes use of the download method's features.*

*Bittorrent is one of the best ways to download any data, especially large sizes. It also alleviates the stress on a single server providing content, as the download is gathered from multiple sources, meaning there's far less bottlenecks when there are high levels of download requests. In fact, due to the nature of the P2P system, the more people who download a file, the faster it goes. It's fast, reliable, and generally far superior to standard browser downloads.*

*There are plenty of legal Bittorrent sites that serve a host of perfectly legitimate content. This includes music, video, applications, and even games. Simply search on Google for legal torrents and you'll find no shortage of them.*

*Aside from this, many websites and companies use Bittorrent as an alternate download option. Drivers, patches, and other larger content often have a Bittorrent link, as companies wish to make use of Bittorrent's features, and reduce stress on their own networks.*

▼ *Bittorrent has an understandably bad reputation, but it's not all illegal downloading*





# ASK JASON



**Meet Jason D'Allison, a veteran of Micro Mart's panel of experts. He's here to help with any technical questions, including anything to do with tablets or smartphones, as well as PCs**

Send your questions to:  
Jason D'Allison  
Micro Mart  
Dennis Publishing  
30 Cleveland Street  
London  
W1T 4JD

Contact Jason by email at:  
jason@micromart.co.uk

While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

*Jason*

## Location, Location, Location

A few months ago, thanks to advice I received on the Micro Mart forums ([forum.micromart.co.uk](http://forum.micromart.co.uk)), I successfully fitted an SSD to my laptop. It's in the bay formerly occupied by the DVD drive (which I seldom used). All's well, but I could only afford a 120GB model at the time and this is now running short of space.

I've had the idea of moving Windows' 'special' file folders – Documents, Downloads, Music, Pictures, and Videos – to the 500GB spinner, which still sits in the laptop's hard-drive bay. It's three-quarters empty, and I could free up 50GB on the SSD at a stroke. With 'normal' folders, I can just cut and paste, but with these other folders, no cut option seems to exist. I'm running Windows 10 – is that the problem? Even if I do move them, will programs know where to find them?

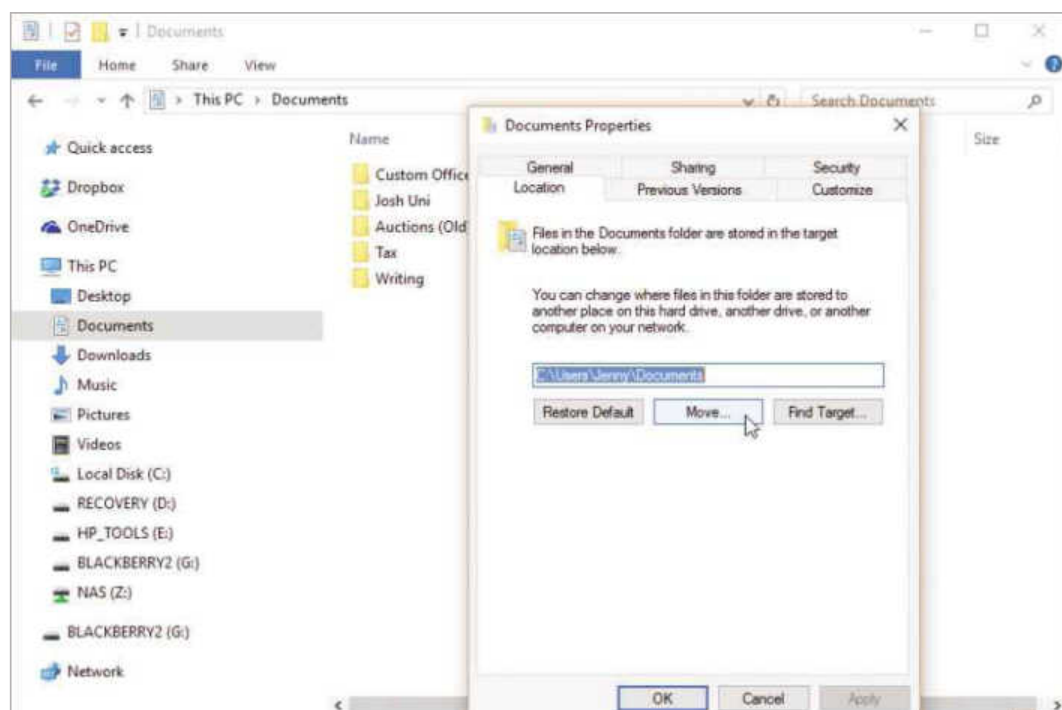
**D Collins, Virgin Media**

*As you've found, Windows' default save folders can't be moved in the same way as user-created folders. It's still straightforward to do, though. Nothing's changed in Windows 10.*

Right-click, say, Documents and select Properties. In the new window, which will show the default root path of C:\Users\[Username], hit the Location tab and click the Move button. In the next new window, browse to the desired folder or drive and click Select Location. Back in original window, click OK. A warning box will appear – click Yes to confirm the action. Finally, repeat the process for any other folders you'd like to move.

Windows will sort out all the tricky stuff that goes on behind the scenes. Your programs will save to and open from the new paths automatically (unless directed otherwise). You're quite right that shunting personal data to a spinner is your best bet when SSD storage is getting tight. Most user files don't really benefit from an SSD's miniscule access times and ultra-fast sequential read and write speeds. Program and system files do, so it's essential to keep them where they belong.

▼ **When SSD space gets low, it's a good idea to move Windows' default file folders to an HDD – but how's it done?**



## Access All Areas

*Here's another problem with folders...*

I've been tasked with retrieving the data off a work colleague's laptop. He dropped it and it won't turn on, but I think the hard drive's okay. I've hooked it up to my desktop PC via a USB enclosure and I can see all the folders, but access is denied – I don't have the correct permissions. Is there a way round this? Surely it must be possible to back the data up, ready for transfer to a new

system. I'm running Windows 7, and I think my colleague was too.

**Stephen Martin, Yorkshire**

*It's a security measure, as I'm sure you're aware. If your colleague's laptop were stolen, his data would be safe from easy access. Of course, such a measure becomes a right royal pane in the glass when someone's innocently trying to back the data up. Luckily – or unluckily for anyone relying on it – it's a doddle to circumvent.*

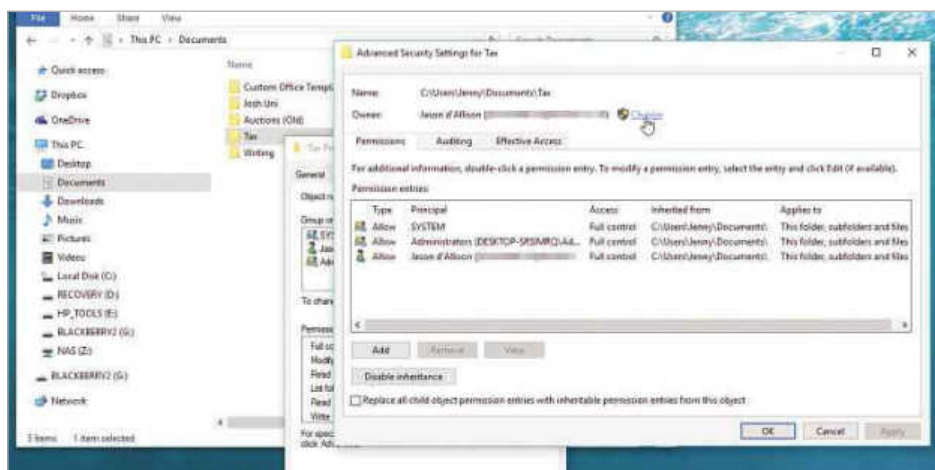
What you need to do, Steve, is 'take ownership' of your colleague's data folders. Make sure you're logged in as an administrator, and for each folder, follow the steps below.

- Right-click the desired folder and click Properties
- Select the Security tab and click Advanced
- Select the Owner tab and click Edit
- Under 'Change owner to', select your own user account
- Tick the box labelled 'Replace owner on subcontainers and objects'
- Click OK
- Click Yes, OK, or Continue as required

Ownership is changed on a file-by-file basis, so the process could take hours if there's gigabyte after gigabyte of data. This is normal – don't be concerned. Once it's all done, you shouldn't have any more permission problems.

Note – The above procedure is for Windows 7. On Windows 8.x and 10, it's slightly different. For readers looking for a guide, cast your optic nerves over this page on the Windows Ten Forums (not affiliated with Microsoft): [goo.gl/5wA7YY](http://goo.gl/5wA7YY).

▼ **Backing up data from someone else's hard drive – who among us hasn't been landed with that chore? – often requires folder ownerships to be changed**



## Something In The Air

I recall reading some while back – probably in Micro Mart – that it's possible to 'push' phone notifications to a PC and use the PC as if it was the phone. I can't remember what the app's called, though. Can you help? I've got a Windows 10 laptop and an Android phone.

**Danny, Gmail**

You're probably referring to AirDroid. There are two parts to this: the phone or tablet app (from Google Play) and the desktop app (from [www.airdroid.com](http://www.airdroid.com)). Install them both and create an account using either. Log into both, and on the mobile app, tap the options icon (three vertical dots, top-right) and select Settings. Enable 'Notification mirror service'.

That's about it, Danny. However, you may find that AirDroid isn't as useful as you'd hoped. On your desktop, you'll see phone notifications for everything – emails, texts, Facebook posts, calls, system alerts. These can be filtered down if you're being bombarded, but the real problem is that all you'll be able to do with most notifications is read them.

It's not possible to use AirDroid to reply to emails, for instance. Also, you'll be able to end calls or initiate them, but you'll still need to take your phone from your pocket to speak and listen. Replying to instant messages is well catered for – if you're using Facebook Messenger, WhatsApp, Kik, or Telegram. For the first two, your phone must be running at

least Android 4.4.x; for the last two, you need at least Android 5.x.

Of course, if you're in front of your PC, your messaging service will already be open (as will your email client, Facebook, and so on), so what purpose does AirDroid actually serve? Well, you'll find that you can both receive and \*send\* text messages, all synced to your phone. That's useful, to be sure, though texting is declining year on year and is already significantly less popular than instant messaging.

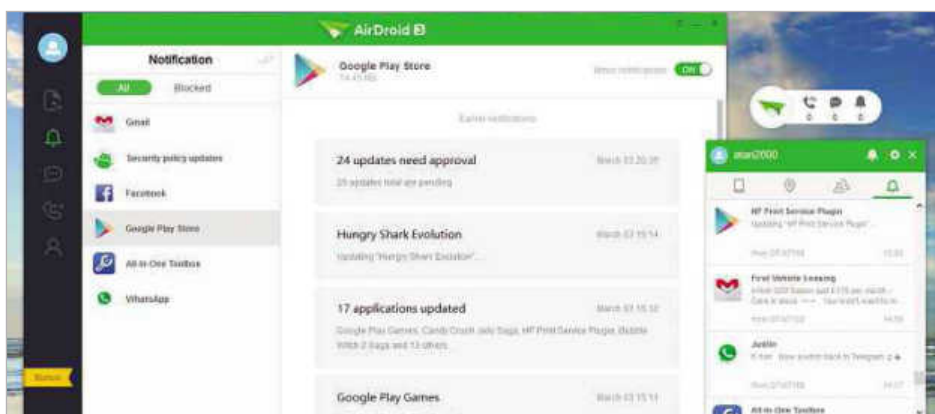
You'll also find that AirDroid allows you to transfer files – from phone to PC or from PC to phone. I like this a lot, but unless you're willing to stump up \$19.99 per year for AirDroid Premium, the transfer limit is just 200MB per month. AirDroid can also mirror the phone's display to the desktop, allowing fairly comprehensive interaction, but your phone will

need to be rooted (unless you're happy to use a USB cable).

For Mac users, there's a version of AirDroid for OS X. There's also a web client that works on any platform. The mobile app is Android-only, however, so any readers who want a similar experience on an iPhone or iPad should try Pushbullet ([www.pushbullet.com](http://www.pushbullet.com)). There's an Android version of this too.

For me, I've tried both AirDroid and Pushbullet, and I've found they do little but add a ton of clutter to the desktop. Not much can actually be \*done\* with them, and they're slow and a bit buggy – works-in-progress. That's just my view, of course, Danny. You should definitely give them a whirl and make your own mind up.

▼ **AirDroid lets you see your phone notifications on your PC, but is there much point?**



# Crowdfunding Corner

**This week's Kickstarter projects are a pair of audio-focused campaigns featuring high-fidelity, specialist-use hardware you can't get in the shops**

## OSSIC X

If you're a gamer or audiophile who likes the idea of 3D sound, the Ossic X headphones are for you. Instantly calibrated to the listener, they create a sense of auditory space thanks to advanced 3D audio algorithms and built-in head tracking abilities. Rather than being noticeably directed into your ears from the speakers, the sound appears to come from all around you thanks to a multi-driver array that plays back sound in multiple simultaneous ways, creating a special surround effect.

For gaming, Ossic X makes a natural companion to VR headsets and competitive play, but it can also enhance the experience of watching movies by offering the wearers cinema-like immersion. For music, it replicates the sound of a concert hall. It's hard to demonstrate by its nature, but the campaign has a lot of graphs, videos and diagrams that should convince you that they're serious about what the technology can do.

It's fair to say that there's confidence in the hardware, because Ossic has raised a million dollars despite aiming for a tenth of that. The cheapest way to get one right now is to spend \$249 (£177) on their Kickstarter-exclusive first run, a saving of \$150 (£106). The hardware is due to ship in January 2017, but it does seem like it'll be worth the wait.

**URL:** [kck.st/1RYtmer](http://kck.st/1RYtmer)

**Funding Ends:** Thursday, April 21st 2016

## Soundboks

The problem with most portable speakers is that they're either a bit weedy or lack staying power. The Soundboks is one company's attempt to create one that doesn't. Designed for outdoor use, the Soundboks claims to deliver "extreme volume", "unbreakable design" and "maximum battery life." All of which sounds great, if true. Indeed, it's so loud the San Francisco police claimed that they'd need a permit to use it.

Despite being battery powered, the speaker can chuck out a massive 119dB, which is as loud as a live concert. The case is shockproof, weatherproof and temperature resistant. The dual batteries charge in three hours and can play for eight hours at maximum volume, 30 hours at medium level and 100 hours at a low level. With a range of 90 feet and a 120° spread, just one Soundboks can cover enough area for almost any occasion.

If you're wondering what might put you off this hardware, then there's only the price to worry about. The cheapest tiers have already gone, but you could still pick one up for \$459 (£325) if you're fast, and \$499 (£354) if you're not. The package includes the speaker, two batteries and an aux cable. The good news? They're planning to ship it in June 2016, so your summer parties can make full use of it.

**URL:** [kck.st/1TqWWuF](http://kck.st/1TqWWuF)

**Funding Ends:** Sunday, April 3rd 2016



*Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!*



# App Of The Week

## PressReader

This week, David Hayward keeps his eyes on the latest news

**K**eeping up with the world news can be a strenuous affair. There are plenty of politically motivated newspapers, news channels and so on, as well as countless other independent sites, papers, magazines and individual blogs to view. Getting to them all can be hard work.

Obviously, we could bookmark dozens of different sites and subscribe to a plethora of newspapers and their respective electronic versions, but there's an easier way.

### The Netflix Of Newspapers

PressReader, a Canadian tech company, offers users the ultimate platform for the latest news stories from around the world.

You'll get unlimited access to more than 5,000 premium newspapers and magazines without having to register with each individual publication. From the app or the site, you'll get content from the likes of the Washington Post, the Guardian, USA Today, the New York Post, the Daily Mail and countless others.

Regardless of what you personally think of each individual publication, PressReader is designed to help you quickly find the most relevant stories and

headlines, trends and opinions from a long list of countries.

By drilling down through the available publications, you can further enhance your home feed to concentrate on certain categories, such as animals and pets, entertainment, current affairs, computing and technology and so on. You'll even find Micro Mart in there.

The app is well laid out, with the main home feed taking up the majority of the screen space, with a section to further read or move on to another story. You can also customise your selections at any time, change languages and take a moment to look into a free preview of a magazine or paper, buy an individual issue or subscribe to a monthly plan.

The website version of PressReader works in much the same way, acting as a virtual broadsheet where you'll receive the latest feeds according to your own personal tastes or through a default view based on the most popular trending articles at that time.

Additionally PressReader improves its service by allowing you to translate news items and by enabling an audio commentary of the news item or across

### Features At A Glance

- Configurable news stream.
- Easily discover content from around the world.
- Download full newspapers and magazines for offline reading.
- Instant translation in up to 16 languages.
- Listen to articles via on-demand narration.

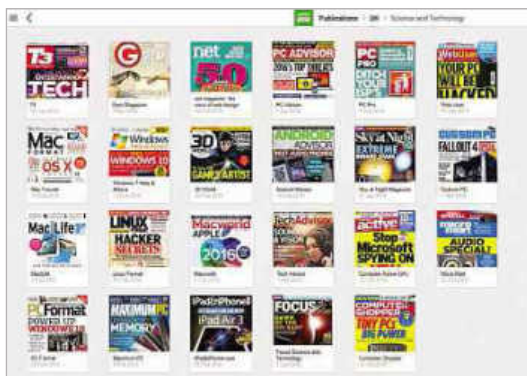
all the current news stream as configured by your personal preferences.

### News Of The World

Despite the rise in social media in recent years, you can't beat getting your head around a well-written and exposing news piece.

So whether you're interested in what Donald Trump is currently up to or you want to read about the latest wearable technology, you can bet you'll find something you like within PressReader.

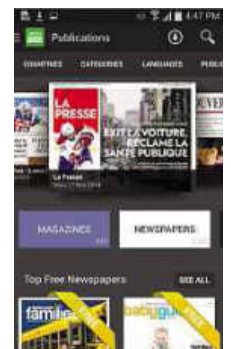
It's a great app and site and available on Android, iOS, Windows Phone, BlackBerry and through any modern browser.



▲ The tech section from the UK offers a selection of decent magazines, along with the rather brilliant Micro Mart



▲ Keep up to date with the latest news via the browser version



▲ If you're on the go, PressReader has you covered for every mobile OS

# Logging Off

**A**fter Intel launched Skylake many people weren't impressed with the limited chip selection, and even smaller number that came unlocked. That made the few 'K' class devices very popular, rapidly draining their stock in the channel and causing street prices to rocket upwards.

When such artificial forces come into play they're often countered by people's ingenuity, it seems, and soon someone worked out that there was a way to unlock Skylake chips that

hadn't been cherry-picked by Intel via its sampling system as best choices for exceeding 4GHz and emblazoned with a 'K' designation. Technically, it was Supermicro that first demonstrated a BIOS that could unlock theoretically locked Skylake processors, but pretty soon most big board makers had Z170 based boards that could unleash the potential in all the range's processors.

To say that Intel went ballistic at this development is putting it mildly. I'm not sure what threats it issued to board makers, but almost overnight these modified BIOS were pulled, and Intel set about making a microcode adjustment to plug the exploit this hack used. This update will be mandatory, I'm told, even if I'm not sure how you can force anyone to apply a firmware update or even a motherboard BIOS enhancement.

I mention all this because it was a topic of conversation I had with a major board maker recently, who quietly offered to provide me with a doctored BIOS, if I wanted to see what my Skylake chip could actually do when unfettered by Intel's training wheels.

There was a time when I'd have leapt at the chance, because over the years I've overlocked almost everything. I think the first thing I tweaked was a BBC Micro, but I've gone beyond the specifications of processors, motherboards, Ethernet adapters, memory, video cards, wi-fi, hard drives and even speeded up a printer once.

As fun as some of these projects were, and the gains in performance that I occasionally got very real, these days I'm not as compelled to abuse stock settings. The problem with overlocking is that when anything goes wrong, my first thought is that I've introduced a stability issue by pushing the envelope. It might not be the case, it might be a bug or a glitch or a failing part, but tweaking does introduce an extra level of uncertainty.

I've also had systems that I massively overlocked, that worked fine initially, and then started to manifest all manner of tiny problems.

## EDITORIAL

**Editor:** Anthony Enticknap  
[theeditor@micromart.co.uk](mailto:theeditor@micromart.co.uk)

**Designer:** Laura Jane Gunnion

**Designer:** Nat Florey-Abbotts

**Bonus John:** John Moore

**Contributors:** Mark Pickavance, Jason D'Allison, Joe Lavery, Sven Harvey, Simon Brew, Dave Edwards, Ryan Lambie, James Hunt, Mark Oakley, Roland Waddilove, , Breakfast Muffins, Sarah Dobbs, David Hayward, Michael Fereday, Ian McGurran, Aaron Birch, David Briddock, Craig Grannell, Kevin Pocock, Andrew Unsworth, Dave Robinson, Rob Leane.

**Caricatures:** Cheryl Lillie

## ADVERTISING

**Group Ad Manager:**

Andrea Mason

[andrea\\_mason@dennis.co.uk](mailto:andrea_mason@dennis.co.uk)

## Sales Executive:

Joe Teal

Tel: 0207 907 6689

[joe\\_taal@dennis.co.uk](mailto:joe_taal@dennis.co.uk)

## US Advertising Manager

Matthew Sullivan-Pond

[matthew\\_sullivan@dennis.co.uk](mailto:matthew_sullivan@dennis.co.uk)

## MARKETING

**Marketing Manager:**

Paul Goodhead

Tel: 0207 907 6393

## PRODUCTION

**Production Coordinator:**

John Moore

[MicroMartAdCopy@gmail.com](mailto:MicroMartAdCopy@gmail.com)

**Digital Production Manager:**

Nicky Baker

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## NEWSTRADE SALES

**Newstrade Director:**

David Barker

## DENNIS PUBLISHING

**Group Publisher:**

Paul Rayner

[paul\\_rayner@dennis.co.uk](mailto:paul_rayner@dennis.co.uk)

## Managing Director:

John Garewal

## Group Managing Director:

Ian Westwood

**COO:** Brett Reynolds

**CEO:** James Tye

**Company Founder:** Felix Dennis

## PUBLISHED BY

**Dennis Publishing**

30 Cleveland Street

London

W1T 4JD

Tel: 0207 907 6000

[www.dennis.co.uk](http://www.dennis.co.uk)

## PRINTING

**Printed By:** BGP

**Distributed By:** Seymour

## Certified Distribution:

13,712 average copies

Jan-Dec 2010





Sometimes running at high speed can make things become unstable, just ask those people trying to make the Boeing's Hypersonic jet WaveRider work.

So these days I'm a huge fan of reliable systems, and less thrilled by the prospect of breaking gigahertz barriers for notional performance gains. Those wanting to overclock their systems just need to spend more money with Intel and not invest any time or effort.

Surely, that sucks the very last drop of enjoyment out of it, and demonstrates vividly that Intel never understood why people did this. The final irony is that PCs go so fast these days generally, that other than posting amazing benchmarks, the motivation for doing this has largely vaporised for many.

This latest dolly departure from Intel's pram is another step on the PCs ladder to becoming an appliance, and us just not caring what's inside them.

*Mark Pickavance*

## LAST WEEK'S CROSSWORD

**Across:** 7 Absolute Pitch, 8 Knight, 9 Status, 10 Hyperon, 12 Decal, 14 Idiom, 16 Courier, 19 Lloyds, 20 Oracle, 22 Intermissions.

**Down:** 1 IBAN, 2 Dongle, 3 Auction, 4 Tense, 5 Mirage, 6 Accurate, 11 Yodeling, 13 Colossi, 15 Oxygen, 17 Roadie, 18 Ask Me, 21 Line.

### DISCLAIMER

The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of the magazine are accurate but the publishers cannot accept responsibility for errors. While reasonable care is taken when accepting advertisements, the publishers cannot accept any responsibility for any resulting unsatisfactory transactions. John's been looking at the post box like a lost puppy for two days now, waiting for a Raspberry Pi 3 to drop through it. Having ordered his for next day delivery about two hours after it was released, he's now starting to get a little frustrated that it hasn't appeared yet. Does he need it

urgently? Not really... If he's honest, he's not short of computers to play with, and hasn't even really worked out what he's going to do with it yet; he's still tinkering with the Pi Zero he finally managed to get his hands on last week, after all (it's a Volumio-powered music streamer blasting out the *Star Wars* soundtrack as we write this. Whatever next?). That's not the point with a lot of technology, though, is it? It's actually quite rare that some miraculous piece of kit fills a gaping hole in our lives any more. It's more likely that we just want it because it's cool. And from where he's sitting, the RPi 3 is looking pretty cool right now. All that pining is a bit unseemly, mind you.

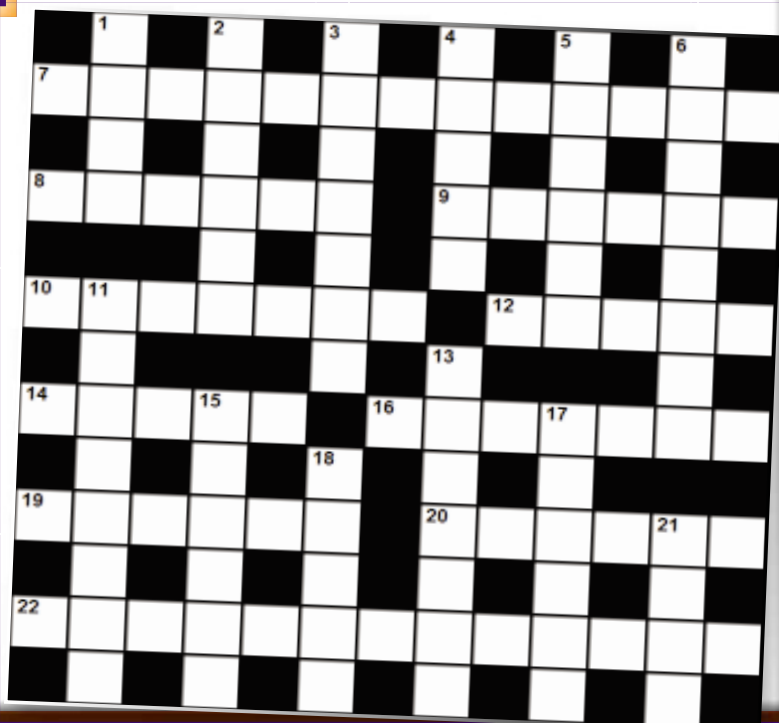
## THIS WEEK'S CROSSWORD

### Across

- 7 The measurement of electrical potential as a technique in chemical analysis. (13)  
8 A communications path from Earth to an orbiting satellite. (6)  
9 A movement back from an impact. (6)  
10 He painted small matchstick figures set against the iron and brick expanse of urban and industrial landscapes. (1,1,5)  
12 In botany the central swelling on the cap of a mushroom or toadstool. (5)  
14 The brightest star in Orion and the seventh brightest star in the night sky (5)  
16 Cardinal numbers that are the sum of six and one. (7)  
19 An irregularly occurring and complex series of climatic changes affecting the equatorial Pacific region and beyond every few years. (2,4)  
20 A businessman who buys or sells for another in exchange for a commission. (6)  
22 In geology the upper layer of the earth's mantle, below the lithosphere, in which there is relatively low resistance to plastic flow. (13)

### Down

- 1 A computer program that performs a series of instructions repeatedly until some specified condition is satisfied. (4)  
2 .mx TLD. (6)  
3 People who tended the furnaces on steamships or steam locomotives. (7)  
4 Undesirable pattern which results from incorrect screen angles on a printed image. (5)  
5 A video camera connected to a computer connected to the Internet, so that its images can be seen by other Internet users. (6)  
6 In geometric group theory a topological space in which every small enough neighbourhood is homeomorphic to a quotient of real space by the action of a finite group. (8)  
11 The use of pretentious superficiality of knowledge - frequently witnessed in forums! (8)  
13 Using or expressed in more words than are needed. (7)  
15 A Hebrew prophet, disciple and successor of Elijah. (6)  
17 Something given as a token of victory or success. (6)  
18 Recite numbers in ascending order. (5)  
21 Gain money, recognition or status through applied effort or work. (4)





# In Next Week's Micro Mart\*

- The best alternatives to the Microsoft Surface
- How to troubleshoot your internet connection
- How open-source AI could change everything
- Plus the usual mix of news, features, reviews and advice



\* May be subject to change

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# ADDON T3

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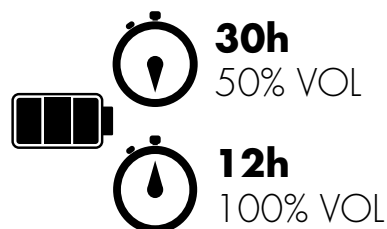


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